THE

JOURNAL OF STATE MEDICINE

The Official Organ

OF

THE ROYAL INSTITUTE OF PUBLIC HEALTH

Editor:

WILLIAM ROBERT SMITH, M.D., D.Sc., F.R.S. Edin.

VOL. XI.

1903

Offices:

19, BLOOMSBURY SQUARE

LONDON, W.C.

INDEX

The Journal of State Medicine.

THE OFFICIAL ORGAN OF
THE ROYAL INSTITUTE OF PUBLIC HEALTH.

VOL. XI.] JANUARY, 1903. [No. 1.

THE HARBEN LECTURES.

INTERMITTENT FEVER.

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LECTURE II.

IN my first lecture I submitted to you what I hope will prove to be better methods of diagnosis in intermittent fever than those now in common use, and I shall now consider some interesting points which may, perhaps, be elucidated by their means. I hope that we shall be in a better position to decide the important question as to what becomes of the parasites between the relapses of fever, to which, as is well known, old cases are subject. This has long been a very interesting question. If we put aside the gametocytes, which are meant for the infection of mosquitoes, and are not directly connected with the production of fever, and which often persist in the blood for long after the attacks, we shall notice that the remaining parasites—namely, the forms which produce spores and cause the fever—fluctuate much in numbers from time to time. They are, as a rule, very numerous when the fever period is present. At such times it is generally, but not always, possible to detect them easily in the ordinary preparations. I think we may say that, as a general rule, if fever is present more than 1 in 100,000 corpuscles contains a parasite of

the spore-producing cycle. In the majority of cases, however, the number is much larger than this, and in some instances it is possible to find 1 in 50 corpuscles infected, or even more—in fact, we may put the minimum number of parasites required to produce fever as 1 to 100,000 corpuscles.

Assuming that there are 5,000,000 corpuscles in a physiological unit of blood, this means that in the same unit there must be a minimum of fifty parasites, while the maximum of parasites may rise as high as 100,000 to the unit. When in ratios like this, the parasites can be detected in ordinary preparations, although sometimes with considerable difficulty. Hence it follows that when a patient has fever it is generally possible to detect the organisms in his blood. After the febrile period, however, the number of parasites begins to diminish, and sinks below the minimum number mentioned above. It then becomes difficult or impossible to find them in ordinary preparations, excepting, of course, the gametocytes, when present. At this time the patient's health rallies a great deal, and the physician is apt to consider that he is cured, especially when he fails to obtain a positive result on examination of his blood. Presently, however, it often happens that, owing to a chill or other cause, the fever commences again, and this relapse is usually again attended with the presence of parasites in the blood in numbers sufficient for detection in ordinary preparations. The patient rallies again, and then another relapse may come on, again attended by parasites. It is a question which has not yet been decided where the parasites live during the intervals between the febrile periods, and in what form they then exist. It is clear that they must continue to exist somewhere or in some form or other within the body during this period, because it often happens that these relapses occur in patients who are removed from malarious localities; for example, in patients who have come to England from Africa. There is some dispute as to how long the parasites may occupy the body in this manner, causing relapses from time to time.

I have heard of many cases who got attacks of malarial fever very many years after leaving the place where they were infected.

I have heard of a lady who was subject to such attacks for twenty years, but the case was not verified by examination of the blood. I certainly saw one case at the Royal Southern Hospital in Liverpool where a relapse attended by parasites occurred four years after the patient, to judge by his own statement, had left the tropics to reside in England.

Whatever length the infection lasts, however, the question still remains regarding the mode of life of the parasites in the intervals between the relapses. Some writers consider that the parasites become encysted in some unknown manner in the inner organs. There is no positive evidence of this view, although many careful histological examinations of the organs of febricitants have been made. Others have thought that it is the gametocytes which keep the infection alive. Now, however, that we know the true function of this form, we may be permitted to doubt this hypothesis. On the whole, I am of opinion that the parasites continue to breed within the body as usual, except that their numbers are too small to produce fever in the intervals between the febrile paroxysms; in other words, their numbers fall to below the minimum given above, of 50 per physiological unit. For the same reason they are difficult to find in ordinary preparations at these times. When the relapse occurs, then, according to my hypothesis, their numbers increase again, so much so that they not only produce fever, but can be easily detected in the peripheral blood.

Of course, this is only an hypothesis as yet, and, moreover, I believe that it is by no means original with me. But there are many reasons in support of it. For example, in the halteridium of birds the parasites are continuously found, while the birds remain infected. There is no evidence that this parasite encysts itself or makes any departure from the normal and well-known routine of its life. We are able to find the parasites always in this case, because they are extremely innoxious to their hosts, which, it seems, can habitually endure large numbers of them. If this can happen in the case of halteridium, I see no reason why it should not happen with other hæmamœbidæ. In the case of the human parasites, however, we have to deal with a much more

virulent organism, which when in large numbers produces illness in the host, and which therefore cannot be habitually tolerated in sufficient numbers to produce this effect.

As it seems to me, then, what happens is this: After the first moment of infection the parasites increase in numbers unchecked until they reach numbers sufficient to produce fever. If we estimate that the mosquito injects 1,000 blasts at the moment of infection, and that each of these blasts enters a blood-corpuscle, becomes thereupon an amœbula, and starts an ordinary cycle, we shall see that some days must elapse before these 1,000 blasts multiply sufficiently to reach the minimum number of parasites given above as capable of causing fever. If we accept the computation of Vierordt that the quantity of blood amounts to about one-thirteenth of the body-weight, there are something like 25,000,000,000 corpuscles in a man of about 150 lb. weight. If we suppose that 1 in 100,000 of these corpuscles are infected (this number being the minimum required to produce fever), we estimate that the blasts must multiply to a number something like 250,000,000 before the first attack of fever commences. This period is, of course, what is called the incubation period. Theoretically, it should vary inversely as the number of blasts injected by the mosquito, and also inversely as the number of spores which a given species of parasite is capable of producing within a given time. Thus the incubation period in the quotidian parasite should be, *ceteris paribus*, about twice as short as that of the mild tertian parasite, and something like six times shorter than the incubation period in quartan fever. Unfortunately, no adequate researches have been made on these points, but, as I have said, such should be the case theoretically. When, after the lapse of the incubation period, the parasites have reached sufficient numbers, the fever commences.

Some very interesting questions now arise. It is obvious that without the existence of some power tending to check the further increase of the parasites, every patient, when once infected, would inevitably die. The fact that this is not the case absolutely compels us to admit that there is some force which checks the invasion at this point. What this force is we cannot say. It has

been suggested that the check is due to loss of virility in the parasites themselves, but if this is the case, how comes it that they can continue to multiply in the body for years, and can even in some cases cause a fatal result after they have occupied the host for some time? It seems to me to be more in conformity with the results of bacteriology to suppose that the body itself produces some substance capable of checking the infection. To this I will return presently, and we shall now proceed to consider the further course of the infection. I suppose that when the patient has had fever for some days the antagonistic principle referred to acquires greater and greater force, with the result that, even without medication, the number of parasites begins to decrease, and finally falls below the fever-producing point. At the same time, as indicated above, the number of parasites becomes too low for very easy detection, and the patient appears to be free simultaneously both of fever and of the fever-producing organisms. Yet we can see, if we take as a guide the figures given above, that the truth really may be only that the parasites have fallen below 50 per unit, or a total of 250,000,000 per 150 lb. body-weight. In other words, when they are less numerous than this they can continue to multiply without causing marked illness, though possibly they may occasion much malaise, and may maintain the anæmia started by the original paroxysm. Of course, during this period the number of parasites may be small or large as long as they do not exceed 50 per unit of blood. It is clear that even if a few hundreds of them remain alive in the host the infection will continue, and we may suppose that if for any reason the antagonistic principle be momentarily reduced, their numbers can increase again—can exceed the minimum fever limit, and can produce the relapses of fever. Nor, according to this hypothesis, will the infection be extinct until every parasite within the whole body has perished.

As I have said, this remains a mere hypothesis, but I think that it is the most reasonable explanation of the facts which we possess. It seems to me to give a very reasonable and simple explanation of the phenomena which we have observed. At any rate, I hope that the methods of diagnosis which I have suggested

above will enable us to obtain an experimental proof or disproof of the theory.

We now return to the antagonistic principle to which I have referred. As stated, there must be some principle which tends to check the too extravagant multiplication of the organisms. Metchnikoff suggested that the leucocytes played this rôle, but numerous observations now tend to throw doubt upon this idea. For instance, it is seldom that we really find living parasites within the leucocytes. When in Assam I examined much blood together with cellular elements extracted from the spleen of living malaria patients, and certainly I saw very little evidence of the phagocytosis of living organisms. There certainly appears not to be enough of it to account for the checking of the invasion on a large scale. True, the phagocytes take up much dead material produced by the parasites, but there is little evidence to show that they destroy the living hæmamœbæ in large numbers. We must assume, then, that the antagonistic principle is probably some chemical agent which the body has the power to elaborate. It is also probable that this agent is produced in larger quantities the more severe the infection has been; in other words, that the body rallies more effectively after a severe paroxysm. Unfortunately, as we cannot cultivate the parasites, we have no means of testing this theory by observation.

In addition, however, to the principle which is directly antagonistic to the parasites themselves, I hold that there must be a second principle which is antagonistic to the toxins produced by the parasites. I think it is now universally admitted that there must be a toxin produced by the parasites. We can hardly discredit this after the observation of Antolisei that a paroxysm of fever may follow the breaking up of a generation of sporocytes, although the young parasites resulting from this breaking up may be destroyed by quinine. It is therefore not the young parasites themselves which cause the access of fever, but something which is produced by the parent organism, and which escapes into the blood at the moment when the spores are liberated. The existence of a pyrogenetic toxin must be admitted, and it is pretty clear also that the toxin must also be hæmolytic, because

of the well-known fact that after each paroxysm there is a greater destruction of the red corpuscles than can be accounted for by the mechanical action of the parasites. Now, it becomes evident after a little thought that if there were no principle within the body capable of neutralizing or eliminating these pyrogenetic and hæmolytic toxins the latter would certainly accumulate in the course of time and kill the patient.

I like to keep distinct ideas of a principle antagonistic to the parasites themselves, and one antagonistic to their toxin. It seems to me that all the classical symptoms of a paroxysm of intermittent fever suggest this combat between the toxin and the antitoxin. At the onset we have in the rigor an expression of the profound shock given to the system by the sudden introduction of the toxin liberated from many millions of sporocytes. In the succeeding fever we have, I think, an expression of the struggle of the system to produce the antitoxin. Thirdly, in the period of defervescence we have, I think, an expression of the elimination of a neutralized toxin from the system.

There is evidence to show that the antimicrobic and antitoxic principles are distinct in the case of intermittent fever, as in other diseases. For example, as Koch and Daniels have shown, native children in Africa may be found swarming with parasites, and yet to all appearance quite healthy. In such cases we have evidence that the antitoxic principle has acquired full development, while the antimicrobic principle has not yet succeeded in extirpating the invaders. Similarly, I have observed, in some cases which I had left untreated for some time, that the paroxysm continued to diminish in virulence even when the parasites continued to increase in numbers. Here, either the parasites must have gradually lost their powers of poisoning the host, or else the host must have acquired properties for defending himself against those powers.

It will thus be seen that the state of an old case of malarial infection at a given moment will depend upon the play of three factors—the virility of the parasitic invasion, the strength of the antimicrobic principle of the host, and the strength of the antitoxic principle. If the second has not been able to extirpate the

parasites entirely, the patient will remain infected; if the second and third are not strong enough, the patient will continue to have fever; if they are both very deficient, the patient dies. While all this remains theoretical at present, it gives an excellent guide for researches which, I think, can be made, and which should prove highly interesting.

From this point we enter upon a very interesting field—namely, that of the cachexia of intermittent fever. I think I am right in saying that this branch of the subject is not adequately treated in most of the text-books on intermittent fever. The only text-book which does deal with it at full length is perhaps that of Kelsch and Kiener. The reason for this appears to be that most of the popular text-books are compiled upon studies of malarial fever made in fairly temperate climates; and, to judge from them, we do not see in such climates those striking pictures of the chronic disease which meet us in many intensely malarious places in the tropics, as, for example, in numerous Indian villages. There we observe crowds of wretched persons, very anæmic and intensely emaciated, with enlarged livers and spleens, with ascites and dropsy, and, besides, showing evidence of starvation, due to their inability to work. When an observer undertakes the study of such a village, he will be astonished to observe the fact that cases such as these appear to have escaped the notice, at least very largely, of most of the text-book compilers. The reasons why this chronic malaria occurs so much more frequently and so much more gravely in the tropics appear to be three in number. The first is probably that in a continuously hot climate a man is much more exposed to reinfection over and over again by the bites of mosquitoes, while in the more temperate climates the period when such infections are possible is limited to a few months in the year. The second reason appears to me to be that the antimicrobic principle is weakened by a high external temperature. I think that most tropical practitioners will assent to the statement that it is much more difficult to extirpate the infection in a hot climate than in a cold one. Even with the hæmamœbæ of birds I noticed on some occasions when I took infected birds from the plains to the hills in India and back

again that the number of parasites in their blood appeared to decrease in a marked manner a few days after the birds arrived in the cooler climate, and increased again a few days after they returned to the hot one. Daniels and myself also observed that in the winter in Calcutta the sparrows were much more scantily infected with protesoma than in the hot weather. The third reason is probably that in tropical countries the people at large seldom take quinine.

In these cases of the cachexia of intermittent fever we see the full expression, so to speak, of the untreated infection; we observe what the parasitic invasion can do when unchecked by any means, except those provided naturally by the body. I have already discussed this subject at great length in my report on Kala-Azar, published by the Government of India. Certainly in my experience, it may be stated as a general rule that as the liver and spleen become more and more enlarged the number of parasites declines, suggesting that the antimicrobic principle increases in strength with the enlargement of the organs referred to. My opinion has been based, not only upon my own experience, but upon the invaluable testimony of Dr. Daniels, who examined thousands of enlarged spleens at autopsies in British Guiana, and found that as a general rule the enlargement of the spleen was accompanied by a marked diminution of its pigment, so that ultimately many such enlarged spleens were entirely free from melanin (*Brit. Guiana Med. Annual*, 1895 *et seq.*). I myself have found over and over again that the parasites cannot be detected in the blood of these old cases. More than that, when investigating cases of Kala-Azar and chronic intermittent fever in Assam, I often observed the fact that no melanin existed in blood and tissue extracted from enlarged spleens during life.

My theory of chronic intermittent fever, or rather the cachexia, is that the parasites are gradually expelled by the more and more perfect development of the antimicrobic principle of the host, but that this is done only at the expense of much suffering and illness on his part. What exactly causes the enlargement of the liver and spleen has not yet been explained. It may be, and I

have often thought so, that this enlargement may be connected with the precipitation of the black pigment in these organs. I know that Kelsch and Kiener attempt to absolve the black pigment from any accusation of this nature. They assume that this pigment is innoxious, and attribute the mischief in the organs to yellow pigment. Against this view may be cited the fact that, even as admitted by them, the yellow pigment does not begin to appear in the organs until somewhat late in the history of the case; but the spleen notoriously begins to enlarge even after the first paroxysm. I do not see what reason we have for absolving the melanin from a pathogenetic significance. In fact, we see that the patient's paroxysm begins at the precise moment when the black pigment escapes from the sporocytes into the *liquor sanguinis*; that the cells which take up this black pigment show rapid symptoms of degeneration, and that the organs in which the black pigment finds a temporary resting-place are precisely those organs which show marked changes as a consequence of the infection. Another theory to explain the enlargement of these organs was, I believe, first suggested by Dr. Daniels, one of our most profound students of this subject. He thinks it possible that the organs might enlarge in connection with the effort of the body to produce antimicrobic and antitoxic principles. It is impossible to say more upon these points, owing to the want of evidence which meets us everywhere.

Recently a very startling paper, closely connected with the subject of the cachexia of intermittent fever, has appeared from the pen of Dr. Bentley (*Indian Medical Gazette*, September, 1902). In the disease of Assam called Kala-Azar we have all the symptoms supposed to be those of chronic intermittent fever in a marked degree, so much so that the medical practitioners in the Kala-Azar districts were unable to inform me when I investigated the disease in 1898 how to distinguish Kala-Azar from chronic intermittent fever. The only criterion, they said, was that the symptoms of Kala-Azar are more severe. Both Rogers and myself considered, after careful investigation, that Kala-Azar, when recognised as such, is merely chronic intermittent fever, or perhaps, more correctly speaking, its cachexia—that is to say,

a spent infection in which the parasites have been nearly, if not quite, extirpated by the antimicrobic principle of the host, leaving behind a cachexia consisting of anæmia and enlargement of the liver and spleen. We do not consider Kala-Azar to be any special product of Assam, and we agree that precisely similar cases are to be found in hundreds of villages in India and probably in many fever districts in the world. The communication of Dr. Bentley referred to, however, records that when the blood of such cases was tested by the agglutination test for Malta fever it often gave a positive reaction. He argued, then, that the disease is really an aggravated form of Malta fever. Such a view would have the effect of upsetting all our ideas of chronic intermittent fever, and we should now be compelled to suspect that other cases of enlarged livers and spleens, with none or with diminished parasites, must often be really Malta fever. Rogers, however (*Indian Medical Gazette*, October, 1902), has lately questioned the accuracy, or at least the sufficiency, of the agglutination test employed. It seems to have been based more upon sedimentation than upon aggregation. He states also that in many cases of Kala-Azar examined by him the blood gave a negative reaction with Malta fever. In my own experience I recently saw a case with all the symptoms of Kala-Azar, which I was informed gave a positive reaction for Malta fever in India; but when he returned home a second test of his blood, made by Dr. Grünbaum, proved completely negative. It seems, then, that we must doubt the adequacy of the tests upon which alone Dr. Bentley bases his new idea. Apart from this, it may at once be observed that the symptoms of Kala-Azar, and of course also those of chronic intermittent fever, are quite different from anything we know of Malta fever. In the former the mortality is very high, in the latter very low. In the former there are no synovial complications, which are common in the latter. Above all, the great enlargement of the liver and spleen seen in the former are certainly absent in the latter, in which what enlargement of these organs exists seems to be but slight. The general aspect of the two diseases also is quite different; and I think that we cannot as yet accept Dr. Bentley's hypothesis, though I

must admit that I should like to see much more work done upon this subject.

I shall be exceeding the limits of my space if I deal with many more of the very interesting points which exist in connection with this interesting disease. One point I must refer to here, and that is the treatment of the malady in its acute stages—that is to say, when the parasites are present. I am fully aware that many practitioners grasp the full importance of continuing the quinine treatment long enough to extirpate the parasites; but I also observe that many practitioners seem still to remain unaware of the importance of this procedure. Thus it is often seen that patients are directed to take their quinine only during febrile periods and for a week or two afterwards. This is not in my opinion sufficient to extirpate the parasites; it is sufficient only to reduce their number temporarily. Of course, when the drug is remitted, the parasites, which, according to the hypothesis above, may be continuing to breed in small numbers in the host, multiply again and produce relapses. In fact, I think it is due largely to the too early discontinuance of quinine that we see so many relapsing cases of intermittent fever from the tropics. I should say it is impossible to extirpate the parasites under at least four months' continuous medication of the host. I am not fully satisfied that even this period will suffice in every case, but I have known several cases in which it has sufficed, and in which no relapse has afterwards occurred in spite of the patient being subsequently subjected to conditions which were likely to encourage relapses in them. I should like, therefore, to enter a plea before you for the much longer treatment by quinine than seems generally to be adopted at present.

Regarding the large subject of the epidemiology of the disease, I have nothing of interest to tell you that is not already familiar to you. I must, however, deprecate the notion that we know everything in this connection that is to be known. I am particularly not satisfied with the cultivation experiments with different kinds of mosquitoes that have hitherto been made. We do not even yet know the conditions under which a given species of malaria-bearing mosquito will sometimes fail to become in-

fected. Until this is done we shall not be quite secure that some species of gnats which do not belong to the genus anopheles, do not carry the disease. The interesting researches of Christophers, Stephens, James, and Buchanan in India seem to be the only ones which have been recently attempted for attacking this part of the problem. Perhaps the strongest evidence against pot-breeding gnats is that originally cited by the first expedition of the Liverpool School of Tropical Medicine to Sierra Leone. It is that intermittent fever has been immemorially known to be associated with stagnant water on the ground. If it could be carried by pot-breeding insects, this law would never have obtained. For example, yellow fever is carried by a pot-breeding mosquito, with the result that the disease was never associated with stagnant pools, but was thought to be a filth disease like typhoid. I should like to see many more experiments made with different kinds of gnats, placed under varying conditions of temperature and moisture. It seems to me quite possible that a species of gnat which will refuse to take the infection at one condition of temperature and moisture may accept it under other conditions.

OYSTERS AND THEIR SOLVENTS.

Investigations in the *Lancet* Laboratory show that the oyster contains all classes of nutritive material, such as proteid, carbohydrate, fat, and mineral matter, and that for the most part these are present in a readily assimilable form—a remark which applies particularly to the coagulable albumins, to the glycogen, the organic phosphorous compounds, and those substances which on heating or cooking develop the so-called osmazome. Four-fifths, however, of the raw mollusc consist of water—about the same proportion as is found in beef and mutton. Copper seems to be a constituent common to all oysters, but in a very minute quantity. The best solvent of the oyster, next to cold water, is diluted gin. Chablis and champagne are good solvents, but stout, which many people fancy, has, it appears, no effect on the oyster, because stout already contains a relatively large proportion of soluble matter.

THE VACCINATION ACT, 1898, AND ITS RENEWAL.*

By FRANCIS T. BOND, M.D. Lond.,
Honorary Secretary of the Jenner Society.

There are some persons who may object to the title of this paper, that it involves what logicians call a *petitio principii.* It will be said by one class of objectors that the merits of vaccination are so questionable that it is not expedient that the Act should be renewed at all, and that not only it but all other existing legislation on the same subject should be repealed.

This is the contention of the Anti-Vaccination League, and it is a very clear one. The reply to it is equally clear. It is that the merits of vaccination have been exhaustively investigated by a Royal Commission of the most eminent men who could be suggested for the purpose, on which the case against vaccination was championed by competent representatives; and though a small minority of the Commissioners disagreed upon some important points with the large majority, yet they were unanimous in recommending that the State machinery for vaccination should be maintained. Now, they could not have agreed on this recommendation if they were not also agreed that vaccination has some efficacy as a protection against small-pox, and that, therefore, some legislation is necessary for its maintenance. We may, consequently, clear off at once this ground of objection to further legislation, and may assume that the efficacy of vaccination must be regarded as *res judicata,* and that it is superfluous to discuss it.

But there is another class of critics who may object to the assumption in the title of this paper, though for a very different reason. Looking, as they are apt to do, on the Act as mainly important from its containing what they consider a weak-minded concession to the so-called "Conscientious Objector," their dislike of this unwelcome creation of modern legislation is so great that they would rather see the Act lapse altogether than that it should be renewed with this provision in it. This was the view

* A paper read at the Exeter Congress of The Royal Institute of Public Health, 1902.

of the majority of the members of the House of Lords when the Vaccination Bill was sent up to them from the House of Commons, and it required all the pressure which Lord Salisbury could bring to bear on his unruly followers, backed by such support as Lord Lister felt able to give him, to force the Bill through the Upper Chamber.

But it is scarcely going too far to assume that this class of objectors must have considerably diminished both in numbers and in weight since that time, and that the experience which has accumulated during the four years in which the Act has been in operation must have convinced even the most irreconcilable of these pro-vaccination enthusiasts that if the Government were to allow the Act to lapse without replacing it by some enactment of a similar kind, though possibly in a modified form, they would be undertaking a grave responsibility, which might seriously embarrass even so strong a Ministry as the present.

Even if the Act contained no other provision than that of domiciliary vaccination, its lapse would be a misfortune, to say nothing of those sections which provide for the adoption of glycerinated calf-lymph, the extended use of which has fully justified itself.

There are few persons outside the limited circle of those who profess to disbelieve in vaccination altogether who would question the propriety of embodying these temporary provisions in a permanent statutory form, and it may therefore be assumed that as they must be dealt with, the other provisions of the Act must also come under review for the purpose of considering whether they shall also be renewed, and if so, in what form.

It will probably facilitate the discussion of these questions if we briefly refer in the first place to the less contentious clauses of the Act, and thus get them out of the way.

Section 1 extends the period within which a child must be vaccinated, subject to exemption as provided, from three to six months. There cannot be much doubt that this was a salutary alteration, and there are probably many who will think that, for reasons which it is not worth while discussing here, the example of the German law might be followed with advantage, and the

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period be extended to the end of the year after that in which the child was born.

In connection with this point it is well to bear in mind that the risks which very young children run of illness or death from small-pox are very small, under our present system of sanitary control, when compared with those which they incur from the disturbances which vaccination produces occasionally at that age, and there are probably not a few who will agree that if primary vaccination were postponed altogether until the child arrives at the school age, except in the presence of an outbreak of small-pox, when pressure to have the child vaccinated is expedient, there would, on the whole, be more gain than loss from such an alteration of the law.

Sections 2 to 5 provide for the offer of vaccination with glycerinated calf-lymph at the home of the child, except where it is in an insanitary state, and protect the child from being summarily vaccinated in any public institution within the statutory period of six months.

The experience of the working of these provisions has, I believe, been, on the whole, so satisfactory that there is no case for their repeal, though there are points of detail connected with the arrangements for domiciliary vaccination which call for revision. But it is impossible to deal with them here, and they more affect the financial relations of the Public Vaccinator with the Vaccination Authority, as representing the ratepayers, than they do the general principles on which legislation in regard to vaccination should be founded.

Nor is there more need to discuss Sections 3, 4, and 5 of the Act, which repeal the power to inflict repeated penalties on vaccination defaulters and also restrict proceedings under Section 31 of the Vaccination Act of 1867 within reasonable limits, and require that when defaulters are committed to prison they shall be treated as first-class misdemeanants. No sensible person, however much he may desire to promote vaccination, desires to give its opponents any grounds for posing as martyrs.

Sections 6 and 7 empower the Local Government Board to make regulations for the employment of Public Vaccinators and

to enforce the provision of vaccination stations when they may think it expedient to do so. These are provisions which are only likely to be objected to by those who object to vaccination altogether.

Section 8 provides that a list shall be kept of the names and addresses of patients received in any hospital for the treatment of small-pox patients, and that the list shall be open to examination at all reasonable times on payment of a small fee. This is so sensible a provision that it needs no discussion here, though it may possibly require to be modified in some small details.

The last section of the Act, No. 9, repeals certain former enactments which are incompatible with the provisions of the Act, and is purely formal in its character.

From this brief summary of the Act it will be evident that the only portion of it which involves any seriously contentious matter to those who agree with the Royal Commissioners that vaccination does protect against small-pox, and that it is therefore expedient to promote it, is the first subsection of Section 2. This provides that no parent or other person shall be liable to any penalty for the non-vaccination of a child, "if within four months from the birth of the child he satisfies two justices, or a stipendiary or Metropolitan police magistrate, in petty sessions, that he conscientiously believes that vaccination would be prejudicial to the health of the child, and within seven days thereafter delivers to the Vaccination Officer for the district a certificate by such justice or magistrate of such conscientious objection."

The first question which suggests itself in regard to the re-enactment of this provision is, Is it practicable to rescind it? And I venture to think that every politician will have little difficulty in answering this question in the negative. A concession of this kind, once made, cannot be withdrawn unless upon overwhelming evidence that its mischievous effects distinctly overbalance its advantages. In this case there is no such evidence.

For some years past a conviction has been growing in the minds of the more temperate advocates of vaccination that the

practice has more to gain by the judicious exercise of indirect pressure than by the employment of direct compulsion, and that its value as a protection against small-pox would be more generally appreciated than it is among the less educated classes if its supporters took as much trouble to diffuse a knowledge of its claims as its opponents do to misrepresent them.

As far back as 1871 the House of Commons passed a Bill, brought in by the Government of the day, which made one step in the direction of mitigation of severity, by enacting that repeated penalties against vaccination defaulters should be abolished. But the House of Lords, in their wisdom, threw the Bill out, and we have largely to thank repeated prosecutions of single defaulters since that time for the manufacture of vaccination "martyrs," who have in consequence become active opponents of the practice. It would not be difficult to name a considerable number of localities in various parts of the kingdom in which branches of the Anti-Vaccination League have been established by men who have had to suffer repeated prosecutions for what they consider, undoubtedly erroneously, the protection of the best interests of their children.

The Royal Commissioners, in their first recommendatory report (Vol. V.), and still more so in their final report, embodied this conviction in the recommendations that repeated penalties should be abolished, and that some provision should be made to meet the case of parents who persistently object to the vaccination of their children. They expressly state that they make this recommendation in the interests of vaccination itself. The present Government, in the Bill which they brought into Parliament in 1898, adopted the first of these recommendations, which is embodied in Sections 3 and 4 of the Act.

The Government also agreed, after a great deal of pressure, to accept the principle of the second recommendation ; but, as is so often the case with hasty compromises of the kind, they did so in a way which has been fruitful of contention, and has thoroughly satisfied no one. For instead of adopting the suggestion of the Royal Commissioners that the method of obtaining exemption from vaccination for their children should be made at

least as onerous to obstinate objectors as submission to the operation itself would be, they concocted a clause which in many places has reduced the law to a farce by the wholesale way in which exemptions are given away, or has in others allowed over-scrupulous magistrates to harry applicants for exemption under the plea that they wanted to satisfy themselves of what is an impossibility—viz., whether the determination of the applicant not to have his child vaccinated has been arrived at "conscientiously" or not. It is difficult to understand how anyone who claims to be competent to legislate for his country could have ever passed so preposterous a clause.

But the blunders of those who are responsible for having passed this section did not end here.

For, whilst all judicious friends of vaccination were agreed that it was expedient to make a certain amount of concession to parents who expressed distinctly their objection to the vaccination of their children, and who were willing to go through a certain amount of formality for the purpose of demonstrating their objection, there was no need for making the exemption perpetual, any more than there is for granting a parent perpetual exemption on the ground that the actual state of the child's health renders it unfit to be vaccinated at the time when the law requires it to be so. In such a case the requirement of the law is only suspended for a time. And the wise course would have been to suspend in a similar way in the case of the "conscientious objector" the requirement of vaccination, and to make the exemption a temporary one only until the child was about to enter on its school life, when the parent should have been offered an opportunity of reconsidering his objection, which in many cases he probably would do.

Let us hope that Parliament will exhibit more shrewdness when it comes to deal with this matter next year than it did in 1898, and that, while it redrafts the so-called "conscience clause" of the Act in such a way as to give unquestionable effect to the intentions of those who framed it, the concession of relief from the requirements of the law shall no longer be entire, but shall be subject to renewal at least once during childhood.

It is a misfortune that the contentious aspects of this particular section of the Act has thrown so much into the shade a variety of other matters connected with the administration of vaccination in regard to which legislation is urgently needed. Amongst these may be specially noted the desirability of taking vaccination out of the hands of Boards of Guardians and bringing it into relations with sanitary administration, of which it is an essential element; the requirement of the revaccination of children about the end of the school age; the reconstruction of the vaccination certificate, so that it will indicate clearly how far the vaccination of the child has been efficient or not; and a variety of other points of detail which it would be impossible to discuss adequately, and in some degree improper to discuss at all, under the conditions which are imposed on the present occasion.

HEALTH IN THE PUNJAB, 1901.

THE death-rate in the Punjab of 36·1 per 1,000 persons living is more than twice that recorded in London, and can only be explained by the general inaccuracy of vital statistics in India. The highest death-rate of the large towns of the Punjab was recorded at Ludhiana, 56·56 per mille, where there was plague.

Lieutenant-Colonel Bamber, M.S., D.P.H. Camb., the Sanitary Commissioner for the Punjab, points to the indoor life led by women of the Province as a *vera causa* for the extraordinary preponderance of female over male deaths from plague. There was almost no cholera during the year, but small-pox was prevalent in certain districts. The greatest increase took place in the plague mortality, which rose from 495 in 1900 to 14,959 in 1901, simply because the people offered such strong opposition to plague regulations that it was found impossible to continue compulsory measures. The vast majority of cases were bubonic, though cases of septicæmic and pneumonic plague were observed. At the Pasteur Institute of India at Kasauli 321 patients were treated, of whom 146 were Europeans and 175 natives. There were no deaths among the Europeans, and three among the natives.

The number of vaccinations performed was less in 1901 and 1902 than in any year since 1896-97, a fact which is ascribed to the special difficulties that beset the sanitary administration of the Punjab, where unhealthy years have rendered the children in many cases unfit for vaccination, where the mortality among the cattle has lessened the supply of calves, and where the prevalence of plague has so disturbed the people that in the principal Native States it was considered wise to suspend vaccination operations altogether.

LEICESTER AND SMALL-POX—THIRTY YEARS' EXPERIENCE.*

By ALDERMAN T. WINDLEY, J.P.,
Chairman of the Public Health Committee of the Leicester Corporation.

It has been suggested to me that a paper on the subject of Leicester and its treatment or experience of small-pox might be of some interest to this Conference, and possibly of some value as a contribution to a subject of great importance to the nation at large.

It has also occurred to me that it was perhaps time that we of the Leicester Sanitary Authority attempted to put our case and set ourselves right, not only with the medical profession, but with the public generally. For I am afraid in many quarters when Leicester is mentioned people shrug their shoulders, elevate their eyebrows, as who should say, "Oh, Leicester; there is something wrong there." In fact, I am not sure but we are regarded as a lot of fanatics, if not actual cranks, on the subject of vaccination and small-pox. "Leicester, Leicester!" said some gentleman in a Yorkshire town to a deputation from Leicester some years ago. "That is where they refuse to vaccinate and play cricket on a Sunday!" Well, the attempt to play cricket was made by a few Secularists, but it failed, and we have not heard of it since; but it remains true that Leicester is a place where they do not believe in, nor submit to, vaccination, except in infinitesimal numbers when compared with the number of births.

What has been the consequence of the neglect of vaccination on the health of the town, especially when small-pox appeared? It was quite expected by the medical profession that once we had the horrible disease imported our population would be decimated by it—it would spread like wild-fire; and many were the prognostications as to what would happen, uttered, not only by medical men in various parts of the country, but by one of our

* A paper read at the Exeter Congress of The Royal Institute of Public Health, 1902.

Medical Officers of Health, who came to Leicester after our method of dealing with small-pox had been initiated.

Writing in his annual report for 1886, on the neglect of vaccination, this gentlemen said: "The sad feature about the whole business is that it is the young children of the town who are growing up in thousands unprotected, and are running a risk to their lives. They have but to come in contact with the first breath of infection of small-pox to at once contract this loathsome disorder."

And in his report for the following year (1887) in reference to the same subject, he wrote: "Should the present state of things continue to go on, and 10 per cent. only of the children born are vaccinated, as happened last year, then in the course of eight or ten years from the present time there will be accumulated a sufficient amount of inflammable material to warrant the use of the term 'Leicester Experiment' being applied to the town. Whether the present vigilant measures of isolation and quarantine will suffice to successfully deal with any outbreak of small-pox which may then arise, time only can prove. One thing is, however, certain, that any of these unprotected children have but to be brought in contact with a breath of infection from small-pox to almost inevitably contract the disease."

We, as a Sanitary Authority, then, were in this position: We had a Medical Officer of Health, a strong vaccinist, uttering such warnings as I have quoted; we had a committee, the majority of whom were of the same opinion as the Officer of Health as to the necessity of vaccination; we had the medical press and medical men in all parts of England prophesying the most terrible misfortunes as certain to come upon us in time, as the result of the neglect of vaccination; and, as an Authority, we were helpless, for the duty of carrying out the Vaccination Acts rested not upon us, but upon the Board of Guardians, and they were elected by a large majority on the non-compulsory vaccination ticket. This was rather hard upon us, for we received the lion's share of the blame for the neglect on the part of the people of a system which most of us believed in, but in the enforcement of which we had no authority. And, indeed, I am not sure

whether even down to the present time we are not looked upon as the chief culprits.

I have depicted the state of the case as it stood with us in Leicester prior to the year 1877. The question was what should we do, and this leads me to deal with what was for some years spoken of as "The Leicester Experiment," or "The Leicester System of Dealing with Small-pox."

At the time this was begun our then Medical Officer of Health, the late Dr. Johnston, was a firm believer in vaccination, but, as I have said, neither he nor we had anything to do with the enforcement of the vaccination laws. He was, however, responsible for advising us as to the best method of treating small-pox whenever it should arise. What he advised was the immediate removal of cases of small-pox to hospital, the closing and disinfecting of infected houses and bedding, where a case had occurred, and the taking of persons who had been in contact with the patients into hospital quarantine for a fortnight. On this I cannot do better than quote from the doctor's own words. In his Health Report for the year 1877 Dr. Johnston said:

"As the plan which I adopted in the removal of these cases (*i.e.*, small-pox) is novel, and may be found useful by Officers of Health in other towns for preventing the spread of the disease, I may be pardoned if I again draw attention to it. In any house where a small-pox case occurred I endeavoured to impress the inmates with the fact that the removal of *all* the members of the family to the hospital was the best course to adopt, not only as regarded their own individual welfare, but also that of the town at large. And I am glad to say that all complied with my request, left their infected habitations, and became inmates of the hospital. Altogether twenty-two unaffected cases were thus admitted into quarantine, and of these three after admission sickened—the first in forty-eight hours, the second in seventy-two hours, and the third on the twelfth day. All these cases must have been infected before admission, as small-pox appears on the skin on the fourteenth day after the infection of the disease has been received into the system. The epidemic had got firm

footing in the town, as it expressed itself in no less than six different streets. The suppression of what might otherwise have proved a widespread epidemic was entirely due to the *early* information received of the cases affected and the promptitude observed in their removal."

Dr. Johnston upon this urged the Sanitary Committee to go for powers of compulsory notification of infectious diseases, which we did, and we were the third town in the country to secure those powers by means of a local Act.

In the following year, 1878, the disease was again imported; this time by a family of vagrants from London. They had taken up their residence in a lodging-house in one of the poorest localities in the town, and two of them were suffering from small-pox. Notice was given to the Sanitary Inspectors, and the cases were forthwith removed to the hospital. The following day the Medical Officer of Health, after considerable difficulty, prevailed upon all the other lodgers in the house, nineteen in all, to allow themselves to be placed in quarantine at the hospital. The lodging-house thus emptied was thoroughly disinfected, and some of the bedding destroyed. A few days after another case was reported in a house opposite the one where the others had resided. This was at once removed, the parents were quarantined in the hospital, the house being disinfected. The inspectors kept a careful watch over all the houses in the vicinity, but no fresh case appeared, and the outbreak was found to have been stamped out.

"But for the facilities afforded by the hospital," wrote the doctor, "there is no doubt the disease would have spread rapidly over the town, and given rise to great mortality, as it was of a very virulent form—the confluent."

Three of the quarantined people sickened after admission—one on the second day, one on the fourth, and one on the eleventh, showing that each had received the infection previous to entry into the institution.

When these results were reported it was thought too soon to draw any strong conclusions, and, indeed, it was believed that the system would inevitably break down in course of time. To show

what followed I now quote from Dr. Johnston's Health Report for 1883. He says:

"In the last seven years there have been no fewer than seventeen importations of small-pox into the town. In 1877 one importation, and the disease appeared in six separate localities; in 1878 two importations, affecting two houses; in 1880 one importation, but no extension; in 1881 four importations reported, each unattended with extensions; in 1882 four importations, in one of which the disease extended to fourteen different localities before it was subdued; in 1883 five importations reported, in one instance affecting two houses. Notwithstanding this large number of importations, the disease has always been stamped out, and the town thus saved from the distress and mortality which has hitherto accompanied its prevalence."

The doctor then gave a table showing the deaths from small-pox in eleven great towns in each year from 1873 to 1883 inclusive: In London the total of deaths was 8,810; Bristol, 131; Birmingham, 1,085; Nottingham, 58; Liverpool, 825; Manchester, 310; Salford, 494; Leeds, 217; Sunderland, 53; Newcastle, 131; and Leicester, 19.

"The continued exemption from small-pox experienced in Leicester, under so many instances of its importation," he wrote, "was highly satisfactory, and was altogether due to the success which had hitherto attended the efforts of the Health Committee in securing not only the immediate reporting, but also the prompt removal to hospital, of all the cases as they came under notice." He concluded in words which have received striking confirmation in the years that have followed. He said: "A review of the facts here stated will offer to most minds conclusive proof that if Health Authorities throughout the country could only secure the removal and isolation of initial cases of any of the essentially infectious fevers, the excessive mortality now annually arising from them would rapidly be reduced to insignificant proportions when compared with the fatality from other classes of disease."

To proceed. In 1884 there were three distinct outbreaks of small-pox in the town and neighbourhood, and in each instance

the infection was conveyed from London. Six cases were found and removed to the hospital, together with the other inmates of the infected houses, and the disease was stamped out.

In 1885 small-pox made its appearance in four points in the town: three were importations—one from Sheffield, and two from London. The usual methods were adopted, and the disease was successfully stamped out. This was the first year of Dr. Tomkins' experience as Medical Officer of Health in Leicester, and in his Health Report, while admitting past success in dealing with small-pox, he expressed himself afraid that when the unprotected population should have grown up and increased in number "a terrible nemesis would overtake it in the shape of a disastrous epidemic." He also suggested the use of animal lymph to meet some of the objections of the opponents of vaccination. I have already quoted the experience of the same officer in 1886-87, and the fears which he repeated in his reports for those years. In 1888, 21 cases of small-pox were met with in the town. The patients were removed to hospital, and 39 persons were taken into quarantine, 3 of whom developed small-pox whilst under observation. Fifteen tramps were also kept under observation at the workhouse for a fortnight. Despite the discovery of cases in various parts of the town, the disease was again stamped out. In 1889-91 there were no cases of small-pox in Leicester. During 1892, 38 cases were found, Dr. Priestley being now Medical Officer of Health in succession to Dr. Tomkins, deceased. The same methods of isolation and quarantine were adopted, but Dr. Priestley, in common with his predecessors, was of opinion that vaccination modified the disease. In 1893 there were 281 notifications of small-pox, representing 308 cases, and 15 proved fatal. In 1894 there were 9 cases; 1895, 4 cases. During the five years 1896-1900 we were entirely free from the disease. In 1901 there were 4 cases, and during the present year there have been 14 cases. Our present Medical Officer of Health, Dr. Millard, writing upon his experience of the Leicester system—the principal measures of which are now generally adopted—says: "The essential characteristic in the method of combating small-pox in Leicester is the

entire absence of *compulsory* vaccination, which is regarded as so all-important in most places. Against this it has been urged that vaccination has to some extent been resorted to in Leicester. This, no doubt, is true. A handful of the population, including the medical men, sanitary staff, small-pox nurses, etc., are as well vaccinated in Leicester as in any other town, so that a cordon of protected persons can at once be drawn round any case of small-pox which may occur. Persons accidentally brought into contact with the disease also frequently submit to the operation, and amongst the well-to-do classes vaccination and revaccination are freely practised. But all this is quite voluntary, and it may be truly said that compulsory vaccination does not exist. The vast majority of the children and young persons amongst the masses are unvaccinated, and it is in this respect that there is a radical difference between Leicester and most other towns."

I may say here that during the time Dr. Priestley was our Medical Officer of Health (1892-95), the system of taking persons who had been in contact with small-pox cases into quarantine at the hospital was given up, mainly for want of room, during the outbreak in 1893. In lieu of that method the names and addresses of all "contacts" were obtained by the inspectors and daily visits were paid to each house for fourteen to sixteen days. In certain cases where it was thought advisable that the "contacts" should stay away from work information was given to employers, and the Sanitary Committee awarded these persons various sums to make up in part for loss of wages. This plan has proved satisfactory, and is being pursued at the present time.

The facts of Leicester, briefly summed up, then, are that whereas in 1872, when the anti-vaccination movement had scarcely been heard of, and when Leicester was looked upon as a well-vaccinated town, there were 346 *deaths* from small-pox, and during that severe epidemic a hospital was built, after plans adopted in London at that time. In the years that followed, faith in vaccination was weakened, and the movement against compulsion became so strong that many persons suffered im-

prisonment rather than pay fines, and many others had their goods seized and sold on account of their refusing to have their children vaccinated. I have quoted from the reports of our Officers of Health as to what they expected would happen, say, in ten years from 1886. During that period the number of children vaccinated was reduced till it was down to less than 2 per cent. of the births. We have seen how each successive outbreak was controlled, and the disease was stamped out. The fears expressed have not been realized, the nemesis has not overtaken us. It is not surprising, therefore, that the feelings of the people on the subject of vaccination should remain virtually unchanged.

In conclusion, I may add that during the period referred to in this paper the Sanitary Authorities in Leicester have been engaged in carrying out the provisions of the Public Health Acts. The old middens and most of the ash-pits have been abolished, the courts have been repaved, and sanitary appliances introduced; thousands of surface wells were closed, and the public water-supply put on; a new main drainage scheme has been carried out, outfall sewers have been laid down, a sewage-farm has been secured, and a constant inspection of houses and removal of nuisances has gone on. A large staff of scavengers and others for the frequent removal of house refuse has been employed. In these various ways—including also the carrying out of a great floods-prevention scheme of river and canal widening all through the town—hundreds of thousands of pounds have been expended. Not only so, but during the same period three large public swimming-baths have been built, and two outdoor baths provided; several extension parks and recreation grounds have been secured. During this time also scarlet-fever cases have been treated in hospital, and within the last two years a new isolation hospital, consisting of seven separate blocks and administrative buildings, has been erected at a cost of £60,000. Since that we have also removed and re-erected several large wood and iron hospital wards for the reception and treatment of small-pox. The result of these various measures, involving, as they have done, the expenditure of great sums of money, is that we can claim to be

one of the healthiest manufacturing towns in the country. Our death-rate, which in 1872 was 26·95 per 1,000 per annum, was in 1901 15·71.

These facts must be left to speak for themselves. I have not entered upon the merits or demerits of vaccination, because, as I have said, we have had as a Sanitary Authority to act upon independent lines. Our experience has fully confirmed the opinion expressed by Dr. Johnston, and which I gave myself when before the Royal Commission on Vaccination, which will be found in the published report of the Commission. I do not see why the plan adopted in Leicester of dealing with outbreaks of small-pox should not be equally successful in every other large town where good sanitary conditions are maintained. And although my opinion met with little apparent favour with the Commission, I was pleased to hear the other day from Dr. Priestley, the Medical Officer of Health for Lambeth, Secretary of the London Society of Medical Officers of Health, that our methods have been largely followed in the Metropolitan boroughs during the recent terrible epidemic of small-pox in London, with gratifying results. I agree with our present Officer of Health, Dr. Millard, that our experience in any case goes to show that *compulsory* vaccination, against which our people have so strongly protested, is unnecessary wherever the Public Health Acts are efficiently carried out, and where on the first appearance of small-pox the Leicester methods are adopted. On the question of vaccination, as upon others of importance, I would say, "Let every man be fully persuaded in his own mind."

No body of men are more influential, perhaps, than those composing the medical profession. They are still able to advise as to the best course, in their opinion, for the public to adopt in relation to vaccination. At the same time, seeing that the evils which they conscientiously believed would follow the absence of vaccination in a great manufacturing town like Leicester have not been experienced, they may fairly be asked to consider whether the time has not arrived when they may give a little credit to Leicester for what it has done in stamping out repeated outbreaks of small-pox, and for being the first to set an example of

the most successful methods of dealing with this loathsome and terribly infectious disease, which has since been followed by nearly all the great towns in the country.

Appendix.

I append a table showing the number of public and private vaccinations from 1872 to the end of last year (1901), together with the births, the cases of small-pox, and deaths from small-pox occurring during the same period.

Year.	Vaccinations.			Births.	Small-pox.	
	Public.	Private.	Total.		Cases.	Deaths.
1872	2,466	1,990	4,456	4,162	—	346
1873	2,145	1,547	3,692	4,447	—	2
1874	2,377	1,387	3,764	4,375	0	0
1875	2,072	1,455	3,527	4,260	0	0
1876	2,080	1,346	3,426	4,781	0	0
1877	2,010	1,643	3,653	4,753	12	6
1878	2,004	1,368	3,372	4,779	8	1
1879	1,942	1,204	3,146	4,687	0	0
1880	1,960	926	2,886	4,830	1	0
1881	1,998	1,419	3,417	4,860	6	2
1882	1,710	1,396	3,106	4,856	29	5
1883	1,203	755	1,958	4,787	12	3
1884	994	769	1,763	4,921	3	0
1885	908	934	1,842	4,652	8	0
1886	611	511	1,122	4,857	1	0
1887	196	275	471	4,679	9	0
1888	72	242	314	4,787	21	0
1889	27	145	172	4,789	0	0
1890	12	119	131	4,699	0	0
1891	6	86	92	4,790	0	0
1892	12	121	133	5,816	38	6
1893	44	205	249	6,006	308	15
1894	29	104	133	5,995	8	0
1895	12	63	75	5,962	4	0
1896	19	67	86	6,212	0	0
1897	11	70	81	6,252	0	0
1898	12	80	92	6,152	0	0
1899	56	100	156	6,273	0	0
1900	155	188	343	6,207	0	0
1901	148	209	357	6,169	4	0

RECENT EXPERIENCE OF SMALL-POX IN LEICESTER.*

By C. KILLICK MILLARD, M.D., D.Sc.,
Medical Officer of Health for Leicester.

A few brief details may be of interest as to the recent experience of Leicester during the time when small-pox has been so prevalent in the Metropolis.

Since February of this year up to the present date (August) there have been seven distinct outbreaks of small-pox in Leicester.

1. The first of these was imported by a workman from Horsham, who developed the disease a day or two after arriving in Leicester, but, owing to the nature of his illness not being at first recognised, the case did not come to the knowledge of the sanitary department till the eruption, which was confluent, had been out three days, and meanwhile the man continued to go about. In spite of this, however, only two further cases resulted.

2. The second outbreak was imported by a tramp from London. This case, although also a confluent one, which afterwards proved fatal, was also not at first recognised, but, although the man was going about the town for four days with the eruption upon him, visiting public-houses, etc., and must have come in contact with a large number of persons, no further cases resulted.

3. The third outbreak was also imported by a tramp, and resulted in one other case.

4. The fourth outbreak was imported by a workman from Bootle, who, whilst engaged upon temporary work in Leicester, suffered from an abortive attack of small-pox, the nature of which was not recognised till three other persons had developed the disease.

5. The fifth outbreak was untraced, a single case only occurring.

6. The sixth outbreak was imported from Wellingborough in the person of an engine-driver, who developed the disease whilst on a visit to Leicester. Although the case was a malignant one which proved fatal, no spread occurred.

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* A paper read at the Exeter Congress of The Royal Institute of Public Health, 1902.

7. The seventh outbreak occurred in July, and the town is not yet clear of it. The origin of it could not be traced, and up to the present it has resulted in six cases in three houses, one of the cases being an abortive attack and unrecognised until two others had arisen from it.

This brings the total number of cases which have occurred to eighteen, including two unrecognised cases. Of these, thirteen were inhabitants of Leicester, and it is noteworthy, I think, that, in spite of the large vaccination default in Leicester in the past twenty years, only five of these thirteen cases were in persons who had never been vaccinated. I may add, incidentally, that of the remaining five cases, not residents of Leicester, and who are known to have brought the disease to Leicester, four were vaccinated persons and one was uncertain.

These figures taken alone are, of course, much too small to generalize from, but taken with Leicester's experience in previous years, as related by Alderman Windley,* and considering that the circumstances under which several of the cases occurred were apparently very favourable for spread, they certainly suggest that the danger of the spread of small-pox, supposed to arise from the presence of a large unvaccinated element in a community, has been somewhat overrated, so far, at least, as casual importations of the disease are concerned.

Personally, I am coming to the conclusion that the real danger of such towns as Leicester lies not so much in their neglect of vaccination in the past as in the intense local prejudice against it, which, it is to be feared, would prevent the great mass of the people from availing themselves of it should a serious epidemic of small-pox unfortunately occur. Even at the present time this prejudice, by preventing persons from being vaccinated who are known to have been exposed to the infection of small-pox, largely handicaps the efforts of the sanitary department to control the disease. Thus, three of the cases of small-pox which have recently occurred, and two of which unfortunately proved fatal, could in my opinion certainly have been prevented had the victims

* In the preceding paper: "Leicester and Small-pox—Thirty Years' Experience."

been willing to submit to vaccination after infection, as the attacks did not develop till eleven, twelve, and thirteen days respectively after the cases from which they were infected had been removed to hospital.

But this prejudice is almost entirely, I believe, the direct outcome of the attempt to enforce vaccination against the will of the people, and often under circumstances in which the necessity for the operation is not very obvious, and it will almost certainly continue as long as compulsion, or rather the attempt at compulsion, continues. Speaking for Leicester, without reference to the country in general, it cannot be denied that compulsory vaccination has been a fiasco; for whilst creating the prejudice I have referred to, the extent and bitterness of which can scarcely be realized by those not familiar with the town, and the danger from which I have indicated, it has utterly failed to accomplish its object. Indeed, it is certain that far more children used to be vaccinated in Leicester before the Act of 1871 (which attempted to enforce compulsion) came into operation.

Unfortunately, Leicester is by no means alone in her attitude towards vaccination. It is true she is generally regarded as the greatest sinner in this respect, and owing to her importance as a municipality, and to the fact that she was one of the first to agitate against compulsion, she has come to be regarded as the Mecca of the anti-vaccination movement. But there are several other important towns in which the law has been set almost equally at defiance.

Such a state of things, it must be admitted by all, is eminently unsatisfactory. How it is to be remedied is a problem yet to be solved. That any attempt to increase the stringency of the law is desirable I cannot for a moment believe, for even if we succeeded in getting most of the babies vaccinated, it is certain that the prejudice would be greater than ever, and it must never be forgotten that vaccination in infancy only can never take the place of individual vaccination after exposure to infection, or of recent vaccination in the presence of a threatened epidemic. Compulsory revaccination of adults has been suggested, and I admit that this is, at least, a consistent course. Revaccination

followed by a third vaccination (of males), as in Germany, would, I believe, be as successful in stamping out small-pox as it has been in that country. But I can scarcely regard such a scheme (of compulsory revaccination) for this country as coming within the range of practical politics, for England is not Germany.

Personally, I think that better results are to be hoped for from an extension and modification of the Conscience Clause of the 1898 Act, by which the loophole afforded for those who are really opposed on principle to vaccination may be made as easy as possible.

The question must also be considered, however, whether, owing to the perfection of our municipal machinery for preventing the spread of small-pox by other means than vaccination, a time is not arriving when *compulsory* vaccination will cease to be any longer absolutely necessary, for it is only so long as such necessity exists that *compulsion* remains justifiable.

It must never be forgotten that vaccinia is, after all, a disease, and those of us whose profession it is to prevent disease should be ready to abandon its use at the earliest possible moment consistent with the public safety. The control of disease by the substitution of one disease for another, whilst it may be expedient, can never be regarded as an ideal method; and whilst I fully recognise the immense and lasting utility of vaccination under certain circumstances—*e.g.*, after exposure to infection—I venture to suggest that universal *compulsory* vaccination need only be regarded as a temporary expedient.

Whether the time has yet arrived when the compulsory law could be entirely relaxed I am not prepared to say, but, in the meantime, I certainly think we should endeavour to learn all we can from the experience of such towns as Leicester, and of such countries as Switzerland, where the experiment of abandoning compulsion has already been made.

Unfortunately, true scientific inquiry in this direction is at present sadly hampered and obscured by the mud raised in the embittered controversy which for many years past has raged round the whole subject of vaccination. Those who are opposed to vaccination waste their efforts, as it seems to me, in futile

attempts to disprove that vaccination confers immunity against small-pox; whilst those, on the other hand, who believe in it appear either to rest content with demonstrating that vaccination does confer immunity, or else are moved by a mixture of enthusiasm and indignation into demanding the enforcement of vaccination with still greater stringency and rigour. And so the really important question gets neglected.

I have referred to the danger arising from the prejudice against vaccination. But there are two other dangers to which Leicester is exposed: one is that arising from errors in diagnosis. Owing to its comparative freedom from the disease in the past twenty years, there are many medical men in the town who have had little or no experience of small-pox, and it is not to be wondered at, therefore, if they do not always recognise the disease at once when they happen to meet with it. It is an important question, I think, whether, in view of the terribly serious consequences which may ensue from an error of this kind, some practical knowledge of small-pox ought not to be required before a medical student can obtain his diploma to practise.

The other danger arises from the presence, even in a town like Leicester, of a considerable section of the population who have been once vaccinated, but in whom, owing to the lapse of years, the protection has become incomplete. Such people are undoubtedly a very real danger to the community, for it is in this class of persons that those mild, abortive attacks of small-pox occur which are so often unrecognised—many of them never come under medical supervision—and which play such an important part in disseminating the disease. We have had repeated experience of this in Leicester. Such cases, however, practically never occur amongst the unvaccinated. It is often said that unvaccinated persons are a danger to their vaccinated neighbours. The force of this I have never been able to appreciate. It is the once vaccinated, who have failed to maintain their immunity by revaccination, who are the real danger to others. Unless we can secure revaccination at the proper time of all who have been once vaccinated, it seems possible that *compulsory* infantile vaccination, which, after all, is a half-and-

half measure, may not be such an unmixed benefit as we have hitherto been taught to believe.

I would remind you that the whole trend of the conclusions arrived at by the Royal Commission on Vaccination, after seven years' deliberations, was in the direction of a relaxation of compulsion. The following extracts from their final reports well illustrate, I think, their attitude:

"We think that ardent advocates of vaccination have not always borne in mind the practical consequences of the attempt to enforce the law in such cases (of conscientious objection). They have maintained that no one has a right to set up his judgment against that of the community embodied in the statute law, and to refuse in consequence to render that law his obedience; they have, therefore, opposed any relaxation of the laws relating to vaccination, assuming that, because in particular instances it might lead to children remaining unvaccinated who would otherwise be vaccinated, it must necessarily result in a diminished number of vaccinations. We believe that this assumption is not well founded. . . . We think these ardent advocates have not always been the wisest friends of vaccination, and that there would have been more vaccinated persons if the law had been enforced with more discretion" (Section 523).

"Too blind a confidence is sometimes reposed in the power of an Act of Parliament. It is thought that if the law be only sufficiently stringent and inflexibly enforced, the desired end is sure to be attained. There is now abundant experience to the contrary. When that which the law enjoins runs counter to the conviction or prejudices of many members of the community, it is not easy to secure obedience to it; and when it imposes a duty on parents, the performance of which they honestly, however erroneously, regard as seriously prejudicial to their children, the very attempt to compel obedience may defeat the object of the legislation" (Section 527).

Although it is usually supposed that the Commission decided by a large majority in favour of the retention of compulsion, it is a fact, nevertheless, that the transfer of only three names (out of a Commission of thirteen) would have actually given a majority *in favour of the entire abolition of compulsory vaccination!*

NOTE ON DR. MILLARD'S PAPER.

It does not appear very clear what the object of Dr. Millard's paper is. Nominally, it is an account of "Recent Experience of Small-pox in Leicester," and it describes seven outbreaks of the disease which have occurred in that town between February and August of the present year. These outbreaks appear to agree generally in the following respects: The infection in each outbreak was imported (as, indeed, it must have been, if the outbreaks were really independent of one another), and in most of them it was not recognised during its early stage, and it did not spread to any material extent. But on this last point we are left in some doubt whether Leicester has enjoyed a second time the good luck which in some degree characterized its experience of small-pox in 1892 and 1893, or whether the failure of the infection to spread was due to the vigour with which, it may be assumed, Dr. Millard, like his predecessors in the important office he holds, has promoted vaccination and revaccination so soon as small-pox has made its appearance there.

The moral, however, which Dr. Millard seems to wish us to draw from this lack of diffusiveness on the part of the disease is that "the danger of the spread of small-pox, supposed to arise from the presence of a large unvaccinated element in a community, has been somewhat overrated, so far, at least, as casual importations of the disease are concerned." But before we can draw this conclusion with any assurance of its correctness we must know what were the relations of the vaccinated and unvaccinated portions of the population of Leicester respectively to the infection in these outbreaks, and also, as has been above suggested, what influence prompt vaccination and revaccination may have exercised in cutting them short; for the diffusiveness of small-pox, as of all other infectious diseases, depends not only on the proportion of the population into which the infection may be imported that is susceptible to it, but to some extent on sheer accident, and in a much greater degree on the energy with which it is controlled by prompt vaccination and isolation. It is a common practice, especially of anti-vaccinists, to apply to locali-

ties indiscriminately the terms "well vaccinated" or "ill vaccinated," on the strength of the greater or less neglect of infant vaccination in those localities in recent years. Some anti-vaccinist controversialists, in their desire to paint Leicester as red as possible, go so far as to talk about it as "unvaccinated." This is, of course, untrue. Even so far as the purely nominal distinction between those who in Leicester have been at some time or other, however distant, and in some degree or other, however imperfectly, vaccinated, the population there is by no means an unvaccinated one. Ten years ago, in the epidemic of 1892-93, out of 357 persons who were attacked by small-pox, no less than 198 are returned as "vaccinated," and Dr. Millard himself mentions it as noteworthy "that in spite of the large vaccination default in Leicester in the past twenty years, only five of these thirteen cases (during the present year) were in persons who have never been vaccinated."

So that, even in Leicester, which is certainly one of the worst, if not actually the worst, vaccinated of all populations in the kingdom, there is a certain element of immunity amongst the adult portion of the population, which must count for something in the chances of limitation of an outbreak. It cannot be supposed that Dr. Millard desires to minimize in any degree the risk which absolutely unvaccinated persons run when brought into unquestionable contact with the infection of small-pox, and it hardly seems wise to say anything which, however intelligible it may be to readers who know how to appreciate such facts as Dr. Millard quotes, may easily lead Sanitary Authorities or the public generally to underrate this risk.

It is clear that for some years to come, even if no effort should be made in Leicester to revive the disregarded requirements of the law in regard to infant vaccination, there will be a residuum of the population which will retain a certain amount of resistance against variolous infection, though it will, of course, be a steadily declining one if infant vaccination is not enforced more than it has been in recent years.

The real question which the authorities of Leicester have to put to themselves, and which they cannot shirk without incurring

a very grave responsibility, is, how far they are justified in gambling with Providence by failing to employ vaccination in addition to isolation as a protection against the spread of small-pox. And that responsibility must be shared by all who aid and abet them in so doing; for it must be clearly recognised that there is only one alternative in the matter. Either vaccination is a protection against small-pox, or it is not. Hitherto the Leicester authorities have professed to act as if there were an intermediate course, at which they have connived, though they have now avowedly adopted it. That course is, whilst ostensibly disregarding and depreciating vaccination, to avail themselves of its advantages by allowing their medical staff to practise it as freely as they thought fit. Now, it is necessary to say distinctly that this course is neither logical nor honest. If the Sanitary Committee of Leicester believe, as one member at least of that body has frequently asserted, that vaccination is not only useless but injurious, it is clearly their duty not to waste the money of the ratepayers on a useless expenditure in promoting it. If, on the other hand, they admit, as they do by implication, in allowing vaccination to be practised on those who can be induced to submit to it, that it has some protective influence, it is equally their duty to advocate it by all the means in their power. This, indeed, they did do, but in a shamefaced sort of a way, during the epidemic of 1892-93, by advising the public to avail themselves of "all the resources of science" to protect themselves against infection.

Dr. Millard recognises the fact that these seven outbreaks are too few to generalize upon, but he thinks that they suggest that the danger of the spread of small-pox from the presence of a large unvaccinated element in a community has been somewhat overrated, "so far, at least, as casual importations of the disease are concerned." This qualification is certainly a very important one, for the experience of Gloucester shows that when once the infection of small-pox lays hold of an unvaccinated population of children it creates as fearful ravages amongst them as it did in pre-Jennerian days.

But it must be further pointed out that it would be very unsafe

to accept Dr. Millard's suggestion even in its modified form. We want, first of all, to know how far he or other medical men who may have been co-operating with him had recourse to vaccination of "contacts" in these outbreaks, or whether they employed prompt vaccination and revaccination at all as means of stamping out the infection. If they did do so, it is clear that the question is not whether it is reasonable to depend on isolation without vaccination, but how far isolation and vaccination combined can, in presence of small-pox, be relied on to stamp it out, as a substitute for revaccination practised before the disease makes its appearance. The answer to this question is equally clear. It is that vaccination is a form of insurance, and that if it is desirable to adopt it at all, it should be adopted before the risk is incurred, and not afterwards, when its effect may be too late.

There could hardly be a stronger indictment of the folly of such a course than Dr. Millard's own statement that "three of the cases of small-pox which have recently occurred, and two of which unfortunately proved fatal, could (in his opinion) certainly have been prevented had the victims been willing to submit to vaccination after infection." This unwillingness Dr. Millard attributes to the general prejudice against vaccination which exists at Leicester, and which he thinks is caused by the attempt to enforce vaccination against the will "of the people." Does he not, in so doing, put the cart before the horse, and attribute to an effect what should really be attributed to its cause? For what has been the cause of the prejudice against vaccination at Leicester, and why is it so much stronger there than in many other towns of equal, and indeed of larger, size, which might, if necessary, be mentioned? It is because for years past an active and not very scrupulous propaganda against vaccination has been initiated and largely carried on by a very small, but very active, section of the inhabitants. Whether it is expedient under the circumstances to enforce the law against those who refuse, or have neglected to avail themselves of, the form of exemption which the Vaccination Act of 1898 provides is a totally different question, and one that need not be discussed here. Dr. Millard says that compulsory vaccination has been "a fiasco" in

Leicester. But why has it not been equally a failure in other places? There may be other Midland towns in which the law has been set at defiance as much as it has been in Leicester, but in the Metropolis, in Liverpool, Manchester, and other large towns, in which an organized agitation against the Vaccination Acts is impracticable, and in which the requirements of the law are enforced systematically, no such general prejudice exists.

It may be conceded, as Dr. Millard suggests, that it is not desirable to increase the stringency of the vaccination law, so far, at any rate, as concerns the penalties inflicted for a disregard of it, but that does not preclude the revision of the exemption clause of the Act of 1898 in the sense of suspending instead of abolishing altogether the liability of every healthy child to be vaccinated. It seems rather inconsequent that after thus depreciating the enforcement of compulsory vaccination Dr. Millard should admit that he is not prepared to say "whether the time has yet arrived when the compulsory law should be entirely relaxed." For at the present time the relaxation is complete to those who care to avail themselves of it. In the strife between those who make "futile attempts to prove that vaccination does not confer immunity," and those who "rest content" in the belief that it is, or "who are moved by a mixture of enthusiasm and indignation into demanding the enforcement of vaccination with still greater stringency and vigour," Dr. Millard says, "the really important question goes neglected." But what is this really important question? If, to use his own words, the attempt to disprove the efficacy of vaccination is "futile," the important question would seem to be, How can those people who at Leicester and elsewhere have been led to believe that vaccination gives no protection against small-pox be induced to see the error of their ways, and the problem of compulsory vaccination be thus stripped of its difficulties? One way, assuredly, is by those who, as sanitary authorities or sanitary officials, do believe in the efficacy of vaccination accepting without reserve the responsibility of expressing their belief in such a way that there can be no mistake as to what their position really is. It is the misfortune of Leicester that those organs of public opinion, who can do so

much to neutralize the mischievous misrepresentations of anti-vaccination fanatics, have ignored the duty which their position imposes upon them, and have either coquetted with grave sanitary danger through want of courage to tackle it, or have led their more ignorant fellow-citizens to believe that Leicester has discovered some peculiar method of escaping the risk of small-pox infection, when it finds its way amongst them, other than that which other towns have adopted. What is wanted at Leicester is a little more courage and a little more honesty on the part of the men of light and leading to impress on the less-instructed portion of the community the convictions which they do not deny that they themselves entertain.

F. T. B.

BACTERIAL TREATMENT OF SEWAGE.

IN the Fourth Report on the Bacterial Treatment of London Crude Sewage, Professor Frank Clowes, D.Sc., the Chief Chemist to the London County Council, states that the following points are established by the experimental work so far undertaken :

1. That by suitable continuous undisturbed sedimentation the raw sewage is deprived of matter which would choke the coke-beds, and the sludge which settles out is reduced in amount by bacterial action to a very considerable extent. This reduction might undoubtedly be increased by the preliminary removal of road detritus.

2. That the coke-beds, after they have developed their full purifying power by use, have an average sewage-capacity of about 30 per cent. of the whole space which has been filled with coke.

3. That the sewage-capacity of the coke-bed, when the bed is fed with settled sewage, fluctuates slightly, but undergoes no permanent reduction. The bed does not choke, and its purifying power increases steadily for some time.

4. That coke of suitable quality does not disintegrate during use.

5. That the bacterial effluent of settled sewage from the coke-beds does not undergo offensive putrefaction at all, even in summer heat, and can never become offensive, but satisfactorily supports the respiration of fish.

6. That the use of chemicals is quite unnecessary in any circumstances when the above method of treatment is employed.

BACTERIOLOGICAL NOTES.

I.

THE EFFECT OF LOW TEMPERATURE UPON BACTERIAL LIFE.

By R. TANNER HEWLETT, M.D., M.R.C.P., D.P.H.,
Professor of General Pathology and Bacteriology in King's College, London.

It is well known that at temperatures not far removed from the freezing-point bacterial activity ceases. It is upon this principle that the various methods of cold storage depend for the preservation of food-stuffs. As a general rule bacterial activity is reduced to a minimum before the freezing-point is reached; below about 40° F. bacteria practically cease to grow and multiply, and the complex phenomena included under the terms "putrefaction" and "decomposition" do not occur. This fact is put to a practical application in cold storage; many articles of food, especially fruit, are damaged by actual freezing, but by adjusting the temperature to between 32° and 40° F. all the advantages of freezing can usually be attained without its disadvantages. Bacterial activity thus ceasing at the freezing-point or thereabouts, an interesting question arises as to whether or no the bacteria are killed by exposure to a low temperature.

The investigation of the effects of low temperature upon living matter was inaugurated by the researches of Dewar and McKendrick,* who found that a temperature of - 182° C. continued for one hour is insufficient to sterilize putrescible substances, such as blood, milk, and flesh. Brown and Escombe† in 1897 exposed a variety of seeds for 110 consecutive hours to a temperature of - 183° C. to - 192° C., obtained by the use of liquid air. After this treatment the seeds were carefully thawed, and it was found that their germinative power showed no appreciable difference from that of the controls, and the resulting plants were equally healthy in the two instances. De Candolle, Pictet,

* *Roy. Inst. Proc.*, 1892, xiii., p. 699.
† *Proc. Roy. Soc. Lond.*, 62, 1897-98, p. 160.

and Chodat* had previously shown that temperatures of from − 39° C. to − 100° C. had no effect upon the vitality and germination of various seeds and the spores of *Mucor mucedo.*

In 1899 Macfadyen† exposed young vigorous cultures in fine-bore tubes to the action of liquid air at a temperature of − 182° C. to − 190° C. for twenty hours. The organisms experimented with were the *Bacillus typhosus*, *Bacillus coli communis*, *Bacillus diphtheriæ*, *Spirillum choleræ asiaticæ*, *Bacillus proteus vulgaris*, *Bacillus acidi lactici*, *Bacillus anthracis* (sporing culture), *Staphylococcus pyogenes aureus*, *Bacillus phosphorescens*, and *Photobacterium balticum.* After being thawed it was found that in no instance could any impairment of the vitality, virulence, or functional activities, ferment action, phosphorescence, pigment production, etc., be detected.

Later, Macfadyen‡ exposed the same species of micro-organisms to the temperature of liquid air for a longer period—namely, seven days. Similarly no perceptible effect could be observed upon the organisms.

Again Macfadyen§ exposed micro-organisms for a prolonged period—namely, six months—to the temperature of liquid air, and once more without appreciable effect; in no case could any impairment of the vitality of the organisms be detected. In this last experiment in some instances the microbes were directly immersed in the liquid air upon cotton-wool swabs or upon platinum loops.

Macfadyen‖ has subjected bacteria, practically the same species as before, to a still more severe test—namely, the temperature of liquid hydrogen, − 252° C., for ten hours. The results were entirely negative as regards any alteration in the appearance or in the vigour of the growths of the organisms. From these experiments it is clear that the prolonged action of the low temperature of liquid air (− 190° C.) or even of liquid hydrogen has no effect upon the vitality of bacteria. It is evident that at

* *Proc. Roy. Soc. Lond.*, quoted by Brown and Escombe.
† *Ibid.*, 66, 1900, p. 180.
‡ *Ibid.*, p. 339.
§ *Ibid.*, 71, 1902, p. 76.
‖ *Ibid.*, 66, p. 488.

this low temperature not only do the ordinary manifestations of life cease, but that the intracellular metabolism must also be practically in abeyance, and the organisms must be in a condition of suspended animation of which we have at present no conception.

These results are certainly very surprising, for many of the bacteria experimented with do not retain their vitality on ordinary culture media for anything like six months. It would seem that their products when cultivated under ordinary conditions, sooner or later prove fatal.

It is remarkable, also, that comparatively large cells, such as yeasts are, should be able to survive the considerable stress to which they must be subjected during the process of freezing and subsequent thawing.

Lastly, it is disappointing that such intense cold does not sterilize. If it did, what an admirable method we should possess for preserving foods and for preparing sterile media, etc., without the application of processes which almost invariably materially alter the constituents!

II.

BACTERIOLOGY FOR GENERAL PRACTITIONERS AND MEDICAL OFFICERS OF HEALTH.

By C. J. RUSSELL McLEAN, M.D., D.P.H.,
Medical Officer of Health to the Doncaster Rural and Tickhill Urban District Councils.

WHILE convinced on the one hand that the practice of bacteriological methods is best carried out by those who have gained experience by a lengthened and special study of the science, together with that of pathology, and who have at the same time a thoroughly equipped laboratory at their command, on the other hand I am just of as strong an opinion that it is absolutely necessary for the general practitioner, as a clinician, to be acquainted with at least the elements of the science, and the rationale of some of the simpler processes in connection with

it, in order that he may at least correctly read the reports of the expert.

To acquire the necessary knowledge for this there are two ways open to him: *First,* by attending a course of practical bacteriology at one or other of the medical schools. (I am here referring particularly to medical men who graduated some years ago, and before such a course of instruction, which is now compulsory, existed in the medical curriculum.) Such a plan is an excellent one were it not for the time required—viz., three months for an ordinary course, or four to six weeks for a post-graduate course. Few busy practitioners can afford to give so long a period, however, and for these I would recommend the second plan—viz., setting up a small bacteriological laboratory at home. By this method much good work can be done and a large amount of valuable information acquired, whilst even if it is the intention to attend a practical course of instruction later on, the lessons learned by home methods will not be lost. In this paper I intend describing only the simpler and less expensive processes, which I have found useful both in general practice and as Resident in a fever hospital, necessary for the recognition of bacteria which are responsible for some of the diseases most commonly met with by the general practitioner, such as diphtheria, tuberculosis, and typhoid fever, and also a few of the pyogenic organisms, and in giving only such details as can readily be carried out by any medical man at home. Anyone further interested and desiring more advanced information may consult any of the numerous text-books on the subject.

APPARATUS—*Staining Solutions.*—Although these may be easily prepared at home, considering the small quantities required, I recommend a beginner to purchase staining solutions ready prepared from a reliable dealer, and as none of them are expensive, there need be no suspicion of waste nor hesitation in discarding any which may have been kept for some time and procuring a new supply, as the fresher the solution used the better the result obtained.

One ounce, or even half an ounce, of each of the following will be ample for our purpose: carbol fuchsin, carbol thionin blue,

methylene blue (if concentrated alcoholic solutions of these are obtained, small quantities of them can be diluted with water —about 1 to 5 for use as required) Gram's iodine solution, carbol gentian violet, and a counter-stain such as Bismarck brown (vesuvin) and Neisser's double stains for diphtheria.

The use of the stains is simplified by having the cork of each bottle perforated and fitted with *tiny glass funnels* (1 inch) containing a piece of folded *filter-paper.* When this is done there is little chance of mixing stains, each solution being filtered on to the cover-slip through its own funnel, any excess being saved by replacing the funnel at once in its own bottle and gently pressing the cork home.

One ounce of *Canada balsam in xylol* kept in a wide-mouthed special bottle and provided with a pointed glass dropper and a cap (for mounting slides); a small bottle of Zeiss' *cedar-oil* kept in a bottle provided with a wooden dropper and cap (for the immersion lens).

Three dozen *glass slides* 3 inches by 1 inch, extra thin, with ground edges, and two with sunk cells for hanging drop preparations. Half an ounce extra thin ¾ inch *square cover-slips,* No. 1. These should be soaked for twenty-four hours in a mixture of 5 parts potassium bichromate and 5 parts strong sulphuric acid in 100 parts of water, well rinsed in clean water and kept in a special cover-glass box in pure methylated spirit. After such treatment the slips are physiologically clean, and before using only require lifting out with a pair of forceps and passing through a flame to remove the spirit, or allowing the slip to dry in air. The former is quicker. One small *Bunsen gas-burner* and a *spirit-lamp.* Two *platinum wire needles* for inoculating. The wire should be 2½ inches long, not too fine, and must be fused into glass handles. One wire to be kept *straight* and the other bent at the point into a fine *loop.* Two or three pairs of *cornet forceps* for holding cover-slips. Half a dozen small *watch glasses. Thermometer* for incubator.

The cost of the above list of articles will not exceed one guinea, but does not include any of the apparatus, such as flasks, beakers, funnels, etc., necessary if one intends making his own culture

media, as I consider it wiser for beginners, who at first only require a few tubes, to buy small quantities of *gelatine*, *agar-agar*, or *blood-serum tubes*, which can be obtained fresh from any reliable scientific instrument dealer or chemist at about 3s. per dozen tubes of gelatine or agar, or in bulk at 6s. per lb., and 6s. per dozen for blood-serum tubes—though why the latter, which involves no more trouble or expense than the two former, should be double the price, I cannot understand. All tubes when received should be covered with small *indiarubber caps*, which can be got for the purpose and kept in a cool cellar till required for use, thereby preventing evaporation of moisture from and drying up of the medium, and rendering it more or less useless for inoculation purposes. By such means I have found gelatine and agar quite active after keeping for upwards of three months, and blood-serum after double that period.

Blood-serum tubes can be readily prepared from pleuritic or ascitic serous effusions, which in general practice are occasionally obtainable. The fluid should be allowed to stand in a tall vessel for twenty-four hours, till a firm clot forms; the clear serum which has separated is then pipetted off into a flask, made faintly alkaline in reaction with sodium carbonate, and about 10 c.c. pipetted into each of a lot of test-tubes and plugged firmly with cotton-wool. The tubes should be then sterilized by exposing to a temperature of 58° C. (136° F.) for one hour on each of five successive days, thereby giving time for the development and subsequent destruction of any spores which may be present, and which as spores would not be destroyed by this temperature. The serum must now be "inspissated," or solidified, by exposure in a slanting position to a temperature of 70° C. (158° F.). The method described is crude, but will be found to give very satisfactory results, and is especially useful for the culture of the diphtheria bacillus. If any doubt exists as to the medium being sterile a tube may be incubated at 37° C. before using.

CHEMICAL NOTES.

The Guaiacum Test for Blood. D. Vitali. (*Giorn. di Farmac. di Trieste*, 1902, vii., 193; *Chem. Zeit. Rep.*, 1902, 252.)—The author finds that guaiacum tincture is only coloured blue by hæmoglobin provided some turpentine oil is present, whereas all other substances which yield a similar colour oxidize the guaiacum of themselves, and do not require the turpentine. To render the test characteristic of blood, therefore, an aqueous solution of the suspected material is mixed with some fresh alcoholic tincture of guaiacum resin, and the whole is warmed to 40° or 50° C. If the mass turns blue some inorganic or animal oxidizing agent is present, and the test is not capable of showing blood; but if it remains colourless, and a blue appears on adding oil of turpentine, blood is undoubtedly to be found in the liquid examined. Ferrous sulphate behaves in the same manner as hæmoglobin, so that this salt must be absent before applying Van Deen's test.

A Colorimetric Method of Determining Arsenious Acid. J. Mai. (*Zeit. anal. Chem.*, 1902, xli., 362-365.)—The author's method is based on the conversion of the arsenic compounds into arsenious chloride, and of the latter into arsenic trisulphide. The determination is carried out in an apparatus similar to that employed by Wiborgh for the determination of hydrogen sulphide. In preparing standard deposits, the arsenic trioxide was cautiously heated with hydrochloric acid (specific gravity 1·19) in a large test-tube and the arsenious chloride slowly distilled over, whilst a current of dry carbon dioxide was simultaneously passed through the apparatus. The gases passed through a U-tube and then into a wide-mouthed tube, the open end of which was covered with moist cotton impregnated with zinc sulphide. The cotton cloth had been soaked in zinc sulphate solution, and then subjected to the action of hydrogen sulphide. It was fixed to the mouth of the tube by means of a rubber ring, and the tube itself was immersed in water saturated with fresh hydrogen sulphide. In order to prevent

the cloth being blocked, a few pinholes were made, which, however, did not allow any of the arsenic to pass through. The mirrors given by quantities of arsenic, ranging from 0·1 to 0·6 milligramme, showed marked differences between each other, but above 0·6 milligramme the increase in intensity was only perceptible after the addition of 0·2 milligramme.

THE QUANTITATIVE DETERMINATION OF SMALL QUANTITIES OF ARSENIC. C. T. MÖRNER. (*Zeit. anal. Chem.*, 1902, xli., 397-413.)—The method is based upon the oxidation of arsenic trisulphide by means of alkaline permanganate,

$$5As_2S_3 + 28KMnO_4 + 27SO_3 = 5As_2O_5 + 14K_2SO_4 + 28MnSO_4,$$

according to which 1 c.c. of $\frac{N}{100}$ potassium permanganate solution is equivalent to 0·0536 milligramme of arsenic. In the titration the arsenic trisulphide is dissolved in alkali (0·5 per cent. potassium hydroxide solution) and treated with 25 c.c. $\frac{N}{100}$ permanganate solution. After shaking the flask, 5 c.c. of 5 per cent. sulphuric acid are introduced, the liquid heated until colourless, and titrated back with $\frac{N}{100}$ permanganate solution.

In applying this method to the determination of arsenic in fabrics, such as carpets, etc., the sample is distilled with concentrated hydrochloric acid, and the distillate received in dilute nitric acid and evaporated to dryness, or the distillate is collected in water, the arsenic precipitated with hydrogen sulphide, the precipitate dissolved in ammonium hydroxide, and the solution evaporated to dryness. In either case the residue will contain organic substances capable of oxidation. To eliminate these the dry residue is heated on the water-bath, and treated successively with 2 c.c. of 0·5 per cent. potassium hydroxide solution; then, after about one minute, with 2 c.c. of 5 per cent. permanganate solution and heated for three minutes; then with 2 c.c. of 5 per cent. sulphuric acid and heated for three minutes; and, lastly, with 1 c.c. of 20 per cent. tartaric acid solution and heated until colourless. The liquid is now filtered into another small basin, the first basin being rinsed with 2 c.c. of water. The second basin is placed on the water-bath, and after about one minute

1 c.c. of 5 per cent. thio-acetic acid is introduced, and the basin heated for three minutes, and left to cool for about five minutes. The precipitated arsenic trisulphide is collected and washed twice with 5 c.c. of 0·5 per cent. sulphuric acid, and then three times with 2 c.c. of water. It is then washed by means of three successive portions of 2 c.c. each of 0·5 per cent. potassium hydroxide solution into a flask containing $\frac{N}{100}$ permanganate solution, and the arsenic determined as described above, with the addition that a correction of 0·3 c.c. is made for substances extracted from the filter-paper by the alkali.

The author gives a detailed account of the results of forty test experiments in which small quantities of arsenic (0·17 to 0·25 milligramme) were added to different fabrics, etc. The differences between the amounts taken and found varied from $-0{\cdot}03$ to $+0{\cdot}04$ milligramme.

Use of Sulphuric Acid as a Solvent for Minerals rich in Arsenic, Iron, and Lead. H. Nissenson and F. Crotogino. (*Chem. Zeit.*, 1902, xxvi., 847.)—The authors call attention to the great superiority of sulphuric acid over nitric or hydrochloric acid for the dissolution of substances containing a large proportion of arsenic or lead. In the first place, conversion of the arsenic and antimony into their more highly oxidized state is avoided, so that the subsequent precipitation with sulphuretted hydrogen is easier to manage; and, in the second place, danger of losing arsenic by volatilization of arsenious chloride is prevented. The material, finely ground and dried at 100° C., is heated with three times its weight of strong sulphuric acid for thirty minutes to three hours—*i.e.*, till everything which is soluble has been attacked; the liquid is then cooled quickly, diluted with hot water (not cold), allowed to settle, and filtered. In presence of antimony the residue is extracted with ammonium tartrate, and the gangue is filtered off; the lead is precipitated with a further amount of sulphuric acid, while any antimony in the filtrate therefrom is added to the bulk solution obtained after treatment of the diluted sulphuric acid solution with sulphuretted hydrogen. In their original article the authors give full details as to the adaptation of their

methods to various ores, such as copper and iron pyrites, arsenical pyrites, lead ores, particularly lead glance, and minerals containing zinc and lead. Zinc ores containing much lead or iron may be very conveniently analyzed, or arsenic and antimony by the same process.

THE DETECTION OF ADDED WATER IN MILK BY MEANS OF THE NITRATE TEST. M. SIEGFELD. (*Molkerei-Ztg., Hildesheim*, 1902, xvi., 161, 162; *Zeit. für Untersuch. der Nahr. und Genussmittel*, 1902, v., [18], 867.)—The author has compared the various reactions for detecting the presence of nitrates in milk, and finds that the formaldehyde test is as sensitive as the diphenylamine reaction. The former test should be made by allowing the milk, to which a drop of formaldehyde has been added, to run on to the surface of pure sulphuric acid. If nitrates be present a violet ring is formed at the junction of the two liquids. It is not advisable to mix the acid and milk, as milk containing no nitrates gives a reddish-violet coloration, which may be mistaken for the nitrate reaction.

(*Note by Abstractor.*—Should the sulphuric acid contain a trace of iron, a blue ring is always obtained with milk containing formaldehyde, whether nitrates be present or absent.)

METHOD FOR THE ESTIMATION OF METALLIC IMPURITIES IN CONDENSED MILK.—J. W. ABBOTT. (*Bull. Massachusetts Health Dept.*, 1900, 37; *Zeit. für Untersuch. der Nahr. und Genussmittel*, 1902, v. [18], 866).—The condensed milk is mixed in a china basin with a third of its weight of sulphuric acid, and subjected to an electric current of 1 to 4 ampères. After fifteen minutes' treatment the whole mass becomes thoroughly charred. The incineration is then readily completed over a free flame, and the ash may be employed for the estimation (electrolytical) of the metallic impurities which may be present.

DETERMINATION OF MERCURY IN TOXICOLOGICAL WORK. C. PIERPAOLI. (*Boll. Chim. Farm.*, 1902, xli., 561; *Chem. Zeit. Rep.*, 1902, 265.)—According to the author, the partial loss of mercury which occurs when animal substances have been destroyed by the Fresenius-Babo process is due to the follow-

ing causes: In the precipitate produced by sulphuretted hydrogen the mercuric sulphide is accompanied by organic matter containing chlorine, from which it cannot be freed by washing with water; on the contrary, by excessive washing part of the sulphide passes into the colloidal modification, and is therefore lost. When the dry impure sulphide comes to be treated with nitric, and afterwards with sulphuric, acid, in order to complete the destruction of organic matter, part of the mercury is converted into chloride by the chlorine present, and volatilized when the sulphuric acid is warmed. As a matter of fact, Pierpaoli has found that if mercuric chloride is heated with sulphuric acid to a temperature not exceeding 170° C. the salt is not decomposed, but volatilizes unchanged.

Detection of Blood Colouring-Matters in Urine. O. Rossel. (*Schweig. Wochschr. Chem. Pharm.*, 1901, xxxix., 557, 558; *Zeit. für Untersuch. der Nahr. und Genussmittel*, 1902, v., 942.)—The urine is strongly acidified with acetic acid and shaken out with an equal volume of ether. A drop of water is added to the ethereal extract, and then 15 to 30 drops of old oil of turpentine or 5 to 6 drops of fresh hydrogen peroxide. After shaking, 10 to 20 drops of a freshly-prepared 2 per cent. solution of Barbadoes aloin in alcohol (70-90 per cent.) are added, and the mixture is again well shaken. In the presence of minute traces of blood—too small to be detected spectroscopically—the aqueous layer becomes distinctly red in colour within three minutes. After ten minutes the colour turns to bright cherry red.

A New Colorimetric Method of determining Mercury in Urine. Schumacher and W. Jung. (*Zeit. anal. Chem.*, 1902, xli., 461-484.)—As a rule, 500 c.c. of the urine are taken, but if subsequently no coloration is given with hydrogen sulphide, the amount of mercury, if present, cannot exceed 0·6 milligramme per litre; and in such cases a litre or more of the urine should be concentrated on the water-bath, with the addition of a few grammes of sodium chloride to prevent any mercuric chloride volatilizing. The 500 c.c. of urine

are heated to the boiling-point with 50 c.c. of concentrated hydrochloric acid and about 5 grammes of potassium chlorate, after which the contents of the flask are cooled to about 80° C., and treated with 12 grammes of pure zinc filings. Eventually an additional 3 grammes of zinc are added, and the flask set aside for two hours. The supernatant liquid is then decanted from the deposit of zinc particles (which will have combined with all the mercury present), and this deposit washed twice with water, then treated for a few minutes with a dilute solution of sodium hydroxide, and again washed twice with water. The residue is now mixed with 50 c.c. of dilute hydrochloric acid and a little potassium chlorate, and heated gently over a small flame until everything has dissolved, more potassium chlorate being added from time to time. The solution is cooled to 70° to 80° C., mixed with about 5 c.c. of alcohol, again boiled, cooled, and transferred to a 100 c.c. flask. The liquid is mixed with a few c.c. of hydrogen sulphide water and made up to the mark, and the colour compared with that given by a freshly-prepared standard solution of mercuric chloride.

The authors state that this is the most rapid and simple method known, and they show by the results of test experiments that it is extremely accurate, whilst being capable of determining 0·1 milligramme of mercury per litre after concentrating the original urine from 3 litres to 1 litre.

Toxicity of Carbon Monoxide. (*J. Gas Lighting*, 1902, 80 [2,062], 1,334.)—With a view of determining the exact proportion of carbon monoxide which, when inhaled with atmospheric air, would prove fatal to mar, U. Mosso has carried out experiments in an iron chamber of 203 cubic feet capacity, lighted by a glass window, hermetically closed by a door, and provided with inlets for the poisonous gas. An experiment in which the subject lost consciousness, and artificial respiration and the use of compressed oxygen had to be resorted to, showed that the proportion of carbon monoxide in air fatal to man is $\frac{1}{233}$, or 0·43 per cent.—A. S.

THE WORK OF THE INSTITUTE.

In wishing the Fellows and Members of The Royal Institute of Public Health every success during the New Year, it will be well for us to record the satisfaction which is generally felt as to the progress and work of The Royal Institute during the past twelve months, and briefly to indicate what is proposed to be accomplished during the ensuing year.

The Council have had prominently before them the desirability of freeing the Institute from the debt necessarily incurred in the obtaining of central and commodious offices, and to this end their efforts have been seriously directed, with the satisfactory result that the close of the year finds them absolutely free from debt, the mortgage on the premises being entirely discharged, and the New Year entered upon free from financial liability, with a considerable balance to carry forward, and not only are the premises thus relieved from debt, but those portions not at present required for the use of the Institute are all let on favourable leases to desirable tenants. The members will, we are sure, join in congratulating the Council upon the successful result of their labours.

The Congress in Exeter, under the presidency of the Right Hon. the Earl of Iddesleigh, was most successful, and the Harben Lectures on Intermittent Fever were delivered by Major Ronald Ross, C.B., F.R.S., who is to be congratulated on recently receiving the International Nobel Prize of £8,000.

The Council have already decided that during the coming year courses of lectures shall be given on the lines of the Gilchrist Lectures by the most eminent lecturers who can be secured in selected Boroughs in London and the Provinces; and the Boroughs in London of Holborn, Fulham, and Southwark have already been selected for this purpose.

The Congress of the Institute for 1903 will be held in Liverpool, and there is every promise that this meeting will be one of the most successful—both as regards numbers and the value of the discussions—which has ever been held. It is contemplated to make arrangements in connection with this Congress which

will result in a material addition to the membership of the Institute.

It will be necessary for important health measures to come before Parliament during the coming Session, more particularly in reference to vaccination, and the subjects will receive most careful attention.

In conclusion, it is with much satisfaction that we recall the fact that His Majesty the King and H.R.H. the Prince of Wales, K.G., have respectively accepted the offices of Patron and Vice-Patron.

The work of The Royal Institute, which has been so successful in the past, there is every indication will be more successful in the future, and that its motto, "Leadeth by the Hand Golden Health," will be more fully realized.

DEATH OF THE ARCHBISHOP OF CANTERBURY.

It is with great regret that we record the death, on December 23, 1902, of the Archbishop of Canterbury, who for many years has taken a great interest in the welfare of the Institute, of which he was an Honorary Fellow.

Dr. Temple has been long prominently connected with many good movements for the social welfare of the people, and his services to the cause of temperance will be long remembered. His loss will be severely felt by many philanthropic movements.

The following letter was written to Mrs. Temple on behalf of The Royal Institute of Public Health:

19, Bloomsbury Square, W.C.,
27 *December*, 1902.

Madam,

It is my sorrowful duty, on behalf of the Fellows and members of the above Royal Institute to express to you our very deep regret at the death of the Archbishop of Canterbury and our sincere sympathy with you in the irreparable loss that you have sustained. The late Archbishop was one of our most distin-

guished Honorary Fellows, and from the year 1894, when as Bishop of London he presided over a meeting held under the auspices of this Institute in King's College, for considering the question of the Housing of the Poor, he has always been interested in our work, and from time to time honoured and encouraged us by attending our meetings, and we cannot refrain from recalling the great influence his Grace exerted in the promotion of temperance and in numerous other directions for the moral and social welfare of all classes of the community.

It is impossible for me to find words to adequately express our feelings of the great loss the Church, the nation, and all good movements have sustained in the loss of one so pre-eminently strong for the truth, and we can only most respectfully and sincerely tender to yourself and his family our condolence and heartfelt regrets.

I am, Madam,
Your obedient servant,
William R. Smith, M.D.,
President.

Mrs. Temple,
Lambeth Palace.

The following letter has been received in reply:

Lambeth Palace, S.E.,
January 1st, 1903.

Mrs. Temple is very grateful to the Fellows and members of The Royal Institute of Public Health for their kind sympathy with her in her great sorrow.

THE ROYAL INSTITUTE OF PUBLIC HEALTH.

The following have been elected members of the Institute:

As Fellows:

Lieut. Abdurrahman Khan Lauddie, M.B., Indian Medical Service, Netley.

F. J. Lenehan, Capt. R.A.M.C., M.B., Mhow, India.

Edward Thomas Pritchard, Esq., M.B., Lecturer on Hygiene, Peking University.

Walter Lewis Thomson, Esq., M.B. Glasg., D.P.H. Camb., Gorseinon, Glamorganshire.

As Member:

John R. Siva Subramaniam, Sanitary Engineer, Madras.

PLAGUE IN HONG-KONG.

Dr. Simpson, in the two memoranda issued by him, suggesting means for dealing with the plague in Hong-Kong, points out the initial necessity for preventive measures—to control and destroy the plague while its microbes are in process of mobilization. He recommends various methods for destroying plague-infected rats, such as the use of cultures of the cocco bacillus discovered by Danysz, and a more systematic crusade against rats, including special measures for the prevention of the importation of rats from ships calling at the port.

Inoculation as a preventive measure is urged, especially if it be possible to induce people to submit to two inoculations within a week of one another, when the protective value of Haffkine's prophylactic is greatly increased. The difficulties of coping with plague in Hong-Kong are enormous, but Dr. Simpson deals with them vigorously. The situation may be summed up thus : (*a*) Between the new year and the date of the last return of the Chinese from the mainland after the Festival of the Tombs in April the danger of importation of plague is greatest. (*b*) The sanitary condition of Hong-Kong is bad because the well-conceived numerous building regulations have failed to effect their purpose. There is considerable overcrowding, very much worse than in Calcutta. (*c*) The emigrants who pass through Hong-Kong in great numbers are not subjected to proper control or regulation. (*d*) The existing organization for acquiring early information of cases, although admirably adapted to English conditions, is not at all suited to the conditions of Hong-Kong. Dr. Simpson suggests that in any future building ordinance the Government should reserve to itself and exercise the right of prescribing the type of house to be built in different parts of the colony. The powers of Government should be used to acquire insanitary areas by compulsory purchase, to destroy existing buildings and reconstruct sanitary buildings.

Regulations as in force elsewhere should be framed for the control of emigrants during their brief sojourn in the colony. To insure early and prompt notification of all cases the responsi-

bility should be thrown on the Chinese residents themselves, as communal responsibility is an idea familiar to them. The town should be divided and subdivided, and each householder served with notices pointing out the importance in his own interests of the prevention of plague, the causes and symptoms of the plague, the steps to be taken when it appears, explaining the intention, and measures of the Government, and warning them that failure to comply with these orders will subject him and all the householders in his district to fine.

A special plague department must be organized, and the existing staff of the Sanitary Board increased and strengthened in various ways. Arrangements might be made with the medical officers of the various Consulates, with the leading medical missionaries, and with the Chinese Customs authorities through Sir Robert Hart, for the submission of a weekly bulletin giving information as to plague-infected areas in China. Dr. Simpson advises a system of medical inspection which is neither surveillance nor quarantine, and which is not to be followed by either of these. Co-ordination of authority and a considerable degree of centralization are necessary. Above all, no measure should be omitted which can enable the Sanitary Authority to attack the plague in its first stages, when its spread is slow.

HEALTH LECTURES IN LONDON.

THE following boroughs in London have been selected for the delivery of these lectures:

Holborn, February 6, 13, and 20; Southwark, March 6, 13, and 20; Fulham, April 3, 17, and 24.

The following lecturers have been appointed for the Borough of Holborn:

1. "Some Discoveries in Preventive Medicine," Professor William R. Smith, M.D., D.Sc., F.R.S. Edin.
2. "Air and Health," Professor Vivian B. Lewes, Royal Naval College, Greenwich.
3. "A Healthy Dwelling-House," Professor Edward W. Hope, M.D., D.Sc., Medical Officer of Health for Liverpool.

THE ROYAL INSTITUTE OF PUBLIC HEALTH.

LIVERPOOL CONGRESS, 1903.

Wednesday, July 15, to *Tuesday, July* 21 inclusive.

ARRANGEMENTS have been made for the work of the Congress to be conducted in the following sections:

1. Preventive Medicine and Vital Statistics.
2. Municipal Hygiene and Sanitary Legislation.
3. Sanitary Engineering.
4. Naval and Military Hygiene.
5. Chemistry, Climatology, and Physics.
6. Bacteriology.
7. Comparative Pathology and Veterinary Hygiene.
8. Tropical Medicine.
9. Sanitation of Congested Areas and Re-housing the Dispossessed.
10. Child Study and Early Education.
11. Port Sanitary Administration.
12. Ladies' Section.

The Right Hon. the Lord Mayor of Liverpool (W. WATSON RUTHERFORD, Esq., J.P.) has accepted the office of Hon. President of the Congress and Chairman of the Arrangement Committee; R. BARROW, Esq., City Controller, that of Treasurer; and EDWARD W. HOPE, Esq., M.D., D.Sc., Medical Officer of Health, that of Hon. Secretary.

The following gentlemen, amongst others, have consented to act on the General Committee:

The LORD BISHOP OF LIVERPOOL.
The Principal of University College.
WILLIAM ANDERSON, Esq.
HARWOOD BONNER, Esq., Chairman of the Finance Committee.
Professor BOYCE, M.B.
Sir JOHN BRUNNER, M.P.
Alderman BURGESS, J.P., Chairman of the Water Committee.
RICHARD CATON, Esq., M.D., F.R.C.P.

Alderman THOMAS CLARKE, M.D., J.P., Chairman of the Port Commissioners.
Sir WILLIAM BOWER FORWOOD, J.P.
Alderman CHARLES GILES, J.P.
ROBERT A. HAMPSON, Esq., J.P.
WILLIAM HANNA, Esq., M.B., D.P.H.
Professor W. A. HERDMAN, D.Sc., F.R.S.
R. D. HOLT, Esq.
JOSEPH HOULT, Esq., M.P., J.P.
JOHN W. HUGHES, Esq.
WILLIAM JOHNSTON, Esq.
Sir ALFRED JONES, K.C.M.G.
CHARLES W. JONES, Esq., J.P.
CHARLES LANCASTER, Esq.
Alderman THOMAS MENLOVE, J.P., Chairman of the Health Committee.
E. K. MUSPRATT, Esq.
A. H. MUSSON, Esq., M.D., D.P.H.
W. OULTON, Esq., J.P.
JOSEPH PARRY, Esq., Water Engineer.
Professor A. M. PATERSON, M.D.
Alderman CHARLES PETRIE, J.P.
E. R. PICKMERE, Esq., Town Clerk.
Alderman PURCELL.
T. SHELMERDINE, Esq., Corporation Surveyor.
Alderman FREDERICK SMITH, J.P.
J. G. TAGGART, Esq.
AUSTIN TAYLOR, Esq., M.P., J.P.
F. T. TURTON, Esq., Assistant Surveyor.
J. UTTING, Esq., L.R.C.P. Edin., M.R.C.S. Eng., J.P.
AUGUSTUS WARR, Esq.
JOHN WOOD, Esq.

The buildings of University College have been placed at the disposal of the Arrangement Committee for the general and sectional meetings of the Congress, and St. George's Hall will be used as a reception-room.

The service on Sunday, July 19, will be held in the Pro-Cathedral.

PUBLIC HEALTH MEDICAL APPOINTMENTS.

THE following Public Health appointments are reported :

ADAMSON, C. H., M.B., F.R.C.S. Edin., Medical Officer of Health to Edmonton.
ARNOLD, F. A., M.B., D.P.H. Lond., Medical Officer of Health to Middelburg.
POLLEN, H., M.D. Dub., Port Health Officer, Wellington, New Zealand.
PORTEOUS, H. L., L.R.C.P. Lond., Medical Officer of Health, Sapperton.
REID, G. M., M.B., Ch.M. Aberd., Health Officer, Shire McIvor, Queensland.
RENDLE, R., F.R.C.S. Eng., Health Officer, Cloncurry, Queensland.
ROBERTS, H. M., M.D., C.M., Medical Officer of Health, Stevenston.
WALKER, T. M., L.R.C.P. Lond., Medical Officer of Health to Banbury.

BOOKS, JOURNALS, REPORTS, ETC., RECEIVED.

THE following papers, books, journals, etc., have been received :

The Lancet ; The British Medical Journal ; The Sanitary Record ; The Surveyor ; The Medical Times and Hospital Gazette ; The Pharmaceutical Journal ; The Councillor and Guardian ; Albany Medical Annals ; Public Health ; The Journal of Applied Microscopy ; The Journal of the Society of Chemical Industry ; Water ; The Journal of Tropical Medicine ; Archiv für Hygiene. Report on Bakehouses in Finsbury. La Mortalitá per Tuberculose in Italia nel 1899. Report on the Outbreak of Small-pox in the Metropolitan Borough of Stoke Newington. The Vaccination Inquirer. Open-air Treatment. Small-pox Possibilities and Obligations, by Frank Tidswell, Sydney. Note on the Serum Therapy of Snake-bite, by Frank Tidswell, Sydney. Report on the Bacterial Treatment of Crude Sewage, by Professor Clowes. Report of the Chief Health Officer, New Zealand, 1901-1902. Registrar-General's Reports, 1898-1900.

Letters, Notes, Queries, etc.

Communications respecting Editorial matters should be addressed to "THE EDITOR, JOURNAL OF STATE MEDICINE, 19, Bloomsbury Square, W.C." *Those concerning business matters, non-delivery of the* JOURNAL, *etc., should be addressed to* "THE SECRETARY, The Royal Institute of Public Health, 19, Bloomsbury Square, W.C."

Communications which have been sent to other journals cannot be received.

Correspondents who wish notice to be taken of their communications should authenticate them with their names—of course not necessarily for publication.

Telephone number of The Royal Institute of Public Health, No. 1614 Central.

The Journal of State Medicine.

THE OFFICIAL ORGAN OF
THE ROYAL INSTITUTE OF PUBLIC HEALTH.

VOL. XI.] FEBRUARY, 1903. [No. 2.

THE HARBEN LECTURES.

INTERMITTENT FEVER.

BY

MAJOR RONALD ROSS, C.B., F.R.S., F.R.C.S.,
Professor of Tropical Medicine, University College, Liverpool.

LECTURE III.

THE great subject of prevention of intermittent fever is one which I am sure will prove particularly interesting to you. The recent discoveries regarding the mode of dissemination of the disease are making a complete reformation in our scheme of tropical sanitation. It is most important that I should place before you a full account of the direction in which this reformation is extending itself. I hope, and I think many of us expect, that the reform will ultimately be of immense advantage to the world. We hope that it will at least assist in opening up great and wealthy countries now debarred to civilization, that it will affect the political map of the earth, and that it will greatly enhance the comfort of the millions of dwellers in malarious countries, not only by the banishment of intermittent fever, but by the improvement of general hygienic conditions, which must ensue if the proper prophylaxis against intermittent fever be adopted.

This prophylaxis is now seen to divide itself into two parts: the personal precautions which any individual can take against the disease, and the precautions which the intelligent municipality or State adopts. I need not trouble you much with the

former. The basis of a personal prophylaxis is obvious—we must avoid being bitten by gnats. It merges itself into a prophylaxis against yellow fever and filariasis, if we adopt the general determination to avoid the bites of all Culicidæ alike. We need only to consider briefly the measures which will subserve this purpose. On the whole, I place in the first position of importance the use of the ordinary "mosquito-net." It is certainly at night that most mosquitoes have their great opportunity, and particularly so when the patient is asleep. I suppose if we could make an estimate of the total number of bites which a person who lives without a mosquito-net receives in twenty-four hours, it will be found that he receives something like 90 per cent. of the bites during his sleep at night. So far as I know, no effort has been made to determine the point from observation, and I speak only from a general impression. If this impression be correct, the use of a mosquito-net during sleep would enable us to avoid 90 per cent. of the mosquito bites which we should receive without it, and would therefore enable us to avoid 90 per cent. of the chances of infection. Even if we put the figure as low as 50 per cent.—and it is probably much higher—we shall see that the mosquito-net is an immense gain as regards personal prophylaxis. So much is this the case that I am inclined to attribute the immense sickness from malaria on the West Coast of Africa as compared with India to the fact that in the former country people have, until recently, seldom used mosquito-nets, while in the latter country their use is almost universal among the whites.

Perhaps the personal precaution which I would place next is that of the use of punkahs. Here again we observe that punkahs are seldom, if ever, used in West Africa; yet they are generally used in India, where very many of the Europeans may be said to live under them constantly, except when taking exercise in the open. Not only do punkahs drive away all insects at times when we are not safely housed in the mosquito-nets, but they keep the body cool and comfortable in the intense and often damp heat of the tropics. This latter advantage is, I am convinced, of itself a great one. Nothing more weakens a man and enfeebles his constitution than the condition of perspiration and

discomfort, assisted by a perpetual annoyance from stinging insects, to which he is subjected if he does not use this most valuable addition to tropical hygiene. Recently, electric fans connected with portable batteries have been made, and have been used by our expeditions in Africa, being found to be very useful. And I hope that the day will come when fans or punkahs will be generally employed by most Europeans in the tropics as they are now employed by the whites in the Southern States and in India.

Another very important personal prophylactic is quinine, but personally I may say that I do not use this unless I am in an intensely malarious place. I am usually content with my mosquito-net; but there are conditions when quinine should be taken, and these are when we have been already much bitten by mosquitoes, or when, owing to any circumstances, we are much subjected to the bites of anopheles during our waking hours. For a patient already infected, quinine also is, of course, invaluable, not only for the purpose of extirpating his infection, but in order to prevent his accidentally infecting his neighbours and reinfecting himself. On the whole, considering that quinine certainly impairs the digestion of most people, and that it is an unpleasant drug to take, I hesitate to recommend it as a general personal precaution except in the special cases indicated above. Another personal precaution consists in furnishing the windows with wire-gauze screens. I am certainly in favour of such screens. They shut out the glare of the sun, the dampness of the rains, as well as many troublesome insects, without impairing the force of the breeze which is so indispensable to our comfort in the tropics. The mosquito-proof rooms shown to me by Sir William MacGregor and Dr. Strachan in Lagos struck me as being a great addition to comfort. Unfortunately, it may be an exceedingly difficult matter to get the majority even of Europeans to use them. The fact is that most Europeans in the tropics live, not in their own houses, but in houses rented from others, and generally rented only at one month's leasehold. The tenant will seldom expend £20 or more for placing screens on the house of another, nor will the landlord do the same for a temporary tenant. It is scarcely

possible that Government will issue orders to all landlords to protect their houses with such screens. The poorest houses in the tropics would scarcely be worth as much as the cost of the screens; others are so pervious in all directions that screens would be quite useless, and it would be legally impossible to force the measure upon a single class of houses—namely, the class which can afford to adopt it. The last personal precaution which I need to mention is that of evicting mosquito larvæ in the precincts of one's own house. As a rule, nothing is easier than this, and nothing adds more to our comfort, although, of course, it is by no means always possible to get rid of all our mosquitoes in this way. I have experienced, however, over and over again, that when all the stagnant water round a house is turned out, then most of the adult mosquitoes, which must perpetually have water to drink or to lay their eggs in, leave the inhospitable dwelling for those of the neighbours which are better provided with what they need. Thus, in a house taken by us at Sierra Leone there were myriads of mosquitoes when we entered, owing to the numerous breeding-places in the back-yard, but within a day or two after these breeding-places were removed the adult mosquitoes disappeared almost entirely. Of course, regarding anopheles, which often come from some little distance, the householder cannot do much in this way to get rid of his visitors; but, at least, he can get rid of the Culices and Stegomyiæ which breed within his own premises, and which constitute generally by far the majority of the mosquitoes in his house.

Let us now turn to the subject of the State prevention of intermittent fever. In State measures I include those of municipalities and of governments placed over municipalities.

The measures which the State can take against intermittent fever may be summed up as follows:

1. The education of the public.
2. Legislation against mosquitoes.
3. The provision of free quinine.
4. Compulsory treatment of all cases of malaria.
5. Segregation.
6. State measures against mosquitoes.

I should say, in the first place, that before attempting to select what State measures we should adopt in a given place, we must remember the local conditions obtaining there. Many of the measures recommended against malaria in the light of the new discoveries have been formulated in laboratories, or by men who have little experience of tropical sanitation and the difficulties connected with it, and who have ignored this fact. Others have been formulated by men whose experience of the disease has been gathered only in temperate climates. Now, it is quite obvious that measures against intermittent fever may be possible in civilized countries which are not possible in countries where the mass of the population consists of blacks. For example, in countries such as the Southern States of America, Italy, and Corsica, it may be possible, simply by educating the people, to get them to adopt the personal precautions described above to such a degree that the disease will rapidly abate of itself. For example, it is certain that intermittent fever used to exist largely in Great Britain, and that it has now disappeared entirely in consequence of some such process (*vide* Nuttall, Cobbett, and Pigg in the *Journal of Hygiene*, 1901). It has disappeared in consequence partly of the drainage of the marshes, partly of treatment by quinine, and partly owing to the improved structure of the houses, and the almost invariable use of glass windows. But we can never hope to persuade the mass of the black population in the tropics to adopt such precautions. They cannot afford even mosquito-nets. They will most certainly not take enough quinine to extirpate the parasites within them, though they may be induced, with much trouble, and if quinine is sold locally at a low price, to give themselves an occasional dose. Again, in a civilized country there is a large medical element capable of encouraging and superintending all sanitary measures; while, lastly, the people can be addressed in their own tongue. In the tropics we have to deal with a completely inert mass, which is scarcely permeable to such ideas. It is therefore obvious that the prevention of intermittent fever is a very difficult thing in the tropics and in temperate climates respectively.

Let us now take seriatim the headings given above. First, as

regards the education of the public in respect to the mode of transmission of the disease. This is very effective in civilized countries, and I agree with Sir William MacGregor that it is likely also to be very useful in the tropics—certainly as regards the whites and the better class of natives. Sir William MacGregor, assisted by his able principal medical officer, Dr. Strachan, C.M.G., has made a great feature of the delivery of lectures both to the whites and blacks on the subject, and tells me that these lectures have certainly done much good. There is no reason why his action should not be repeated in a vast number of tropical countries which are rapidly becoming civilized under European influence. It should be observed, however, that this is, properly speaking, a State measure. The measure will not be adopted, to judge from what I know about it, unless the Government take sufficient interest in sanitary affairs to insist upon lectures being frequently delivered, or pamphlets upon the subject being distributed broadcast. At the most, we must not expect too much from it. We shall reach only the better class of people, and, as I have said, it may be impossible to move the lower strata.

It is thought that much could be done by legislation to force the people to prevent mosquitoes breeding on their premises. I think that such legislation should be adopted, but I hope for little benefit from it in the tropics. Here, especially in places which are not furnished with a good water-supply, all classes have to keep their water in tubs and cisterns. It is very difficult to exclude mosquitoes from these; the smallest chink in the cover will enable them to enter. In many tropical towns, moreover, there are innumerable cesspits, pools for washing clothes, old disused wells, and so on, which the poor householders can never be expected to deal with thoroughly for themselves. This measure cannot, then, be of much importance, except as part of a larger and more effective system.

The provision of cheap quinine has already been undertaken on a very large scale and in a most commendable manner by the Government of India. Any native can purchase a small packet of the drug for a trifling sum at the post-office. But when I was in India I understood that there were many difficulties connected

with the distribution of the drug. It was said to be sold not to the poor, but to enterprising druggists. On the whole, I think it would be better to appoint for each town or large village an intelligent native with a salary to do nothing else but distribute the medicine. The cost of such a man would be but little; his work could be inquired into by the local authorities, and I think he would do a vast deal of good. But even with such an organization I fear that this measure can have but little more than a palliative effect.

Shortly after the mode of dissemination of the disease was discovered, Professor Koch developed his important idea of compulsorily treating all cases with quinine, in order to prevent such cases from infecting the mosquitoes. At that time he held it to be impossible to get rid of mosquitoes anywhere. I think his method to be distinctly a useful one where it can be applied, but it should always be secondary to measures against the insects. Sir William MacGregor has adopted Koch's method to some extent. He compels all Government servants to take the drug, and to report having done so, and he encourages all the civil population to do the same. But, under a British Government, there is a great difficulty in forcing the civil population in this respect. It would be looked upon as an infringement of personal liberty; and I am afraid that where our Government is not strong enough even to force people to be vaccinated once in their lives, they will not be strong enough to force people to take a nauseous drug for four months or more. Moreover, the expense of the measure for a large population of blacks would be considerable. It would be necessary to keep a large staff of medical men to detect the cases and to administer quinine. When we remember that in some places nearly all the native children are infected, and that in order to extirpate the infection of these, they must be treated for some months by the drug, we shall recognise the gravity of the task. Besides this, it may be remembered that few towns are so isolated that market people and travellers are not constantly entering from without and bringing in the infection. I fear, then, that this measure is not generally practicable; but it is practicable to the degree in which Sir William MacGregor

has used it, and I am greatly in favour of using it in this manner. I think that all governments of malarious towns and countries should insist that their employés should use proper personal precautions against the disease, and especially that they should take quinine if already infected. The same should be done by merchants, railway companies, and firms who have many employés.

Much has been hoped from segregation. It was thought that if Europeans live in a separate quarter from the natives they will not be subject to being bitten by so many infected mosquitoes. Segregation is certainly used largely in India, where the Europeans and better class of natives generally live in a separate quarter. To this cause also I attribute the better health enjoyed by the Europeans in that country. But there are great difficulties in the way of segregation where it is not already adopted. It will generally necessitate the building of fresh houses at a great cost. Many business people will object to it because it will disturb their trade. Moreover, it is, in fact, really impossible to obtain complete segregation. The Europeans must have their native servants, and in many cases these native servants must sleep in the houses of their masters. Again, in spite of all precautions, many of the Europeans will not confine themselves to their own quarters. Lastly, the observations of Stephens and Christophers have shown that infected mosquitoes may be found at a considerable distance from the source where they were infected. At Ismailia it should be mentioned that segregation already exists, that nearly all the employés of the Suez Canal Company use mosquito-nets, and that nearly all of them take considerable doses of quinine as a preventive. Yet in spite of all this there is a considerable amount of malarial fever among them.

If we carefully consider these various measures, it will be seen that they are all open to one great objection: they need for their effective conduct co-operation and intelligence on the part of the public, for whose advantage they are applied Thus, either for the use of mosquito-proof screens to the windows, or for general medication by quinine, or for private effort against mosquitoes, or for the use of mosquito-nets, it is necessary that

the public at large shall believe in the discoveries of science connecting intermittent fever with the mosquito, and shall have the energy and intelligence necessary for protecting themselves. Now, every practical sanitarian knows that nothing is more difficult to do than to induce a mass of people, living even in civilized countries, such as those of Europe, to adopt any general measures required for sanitary purposes. How much more difficult will it be to induce the mass of a black population to take such measures? We find it impossible to persuade them even to have themselves vaccinated once in their life; will it be possible to persuade them to take general and increasing precautions against such incessant enemies as mosquitoes? I think not. In fact, we have to find a measure against intermittent fever which can be applied by Government without reference to the volition of the public. Fortunately, such a measure is possible. It consists in dealing with the breeding-places of mosquitoes on a large scale in towns.

Immediately after the life cycle of the parasites in mosquitoes had been determined, I recommended to the Government of India that such measures should be undertaken in the principal cities. My advice was, of course, neglected. Shortly afterwards I discussed the same subject in my inaugural lecture at University College, Liverpool; but at this time, and for two more years, even students of the subject refused to believe in the possibility of getting rid of mosquitoes on a large scale. Many incorrect versions of my recommendations appeared, and other measures were proposed, many of which were founded on but small experience of tropical sanitation. Thus, when the first Liverpool Expedition to Sierra Leone made a careful map of the mosquito breeding-pools in Freetown and recommended that they should be drained away or otherwise dealt with, not the smallest effort was made to act upon our suggestion, and it was not until a gentleman kindly placed at our disposal the sum of £2,000 to undertake the drainage of the worst pools in Freetown, for the purpose of demonstrating by actual experiment whether the mosquitoes there could or could not be reduced by this means, that anything was done. The work was commenced by Dr. Logan

Taylor and myself, and was continued by Dr. Taylor. It has certainly demonstrated that mosquitoes can be much reduced in a large town. At the beginning of last year, also, the American Government began similar operations in Havana with great promptitude, in order to remove yellow fever there. These operations, well directed by Major Gorgas, were also very successful, and, as now admitted by Sir James Crichton Browne in his presidential address to the Sanitary Inspectors' Association, the possibility of evicting mosquitoes on a large scale has been demonstrated.

The advantages of this measure from the point of view of public health over the other measures referred to above are great. In the first place, the municipality or local government can undertake to drain away all mosquito breeding-pools and other collections of water without reference to the public. Secondly, such measures are not likely to evoke resistance from anyone, except in rare instances. The waters which breed anopheles are generally quite useless. Where they cannot be drained away at once, they can be effectively treated by periodical applications of oil. There is no interference with the individual. No one is forced to take a nauseous drug; no one is forced to go to the expense of providing his windows with wire screens; no one is compelled to take the trouble to remove stagnant water from his premises—this is done for him; and people are not even required to protect themselves by mosquito curtains, or to separate themselves from the surrounding population. The measure protects the rich and poor alike. Lastly—and this is a most important point which has been overlooked by those who have opposed my recommendations—the drainage and cleansing of the streets and back-yards of a town required for dealing with mosquitoes cannot but have a good effect as regards the general sanitation of the place.

I must, however, guard myself from misinterpretation. I do not and have never recommended that a general attempt should be made to get rid of mosquitoes throughout any continent. We cannot do so, even if we would make such an attempt. The large towns and villages are the sites suitable for our operations,

and those are also the sites where such operations are likely to do the greatest good to the greatest number. The cost of surface drainage is roughly the same for a square mile of country, whether that square mile be thickly populated or whether it be without inhabitants. But, in the first case, for the expenditure required for the drainage, we shall relieve of a troublesome disease a vast number of people inhabiting that square mile; while, in the second case, we shall relieve only the birds and beasts of the field. Pre-eminently, then, the measure of public sanitation which should be adopted against intermittent fever in the centres of population is a campaign against mosquitoes. It appears unnecessary to compare the comparative value of these measures at greater length; the superiority of one is too manifest to be contested. I may mention also that this measure—namely, surface drainage of the soil—has been sanctioned by the experience of centuries since the time of the Romans, and everyone knows that drainage of the soil removes what is called "malaria."

Of course, the cost and possibility of this measure will vary largely according to local conditions. I think that I have seen most varieties of malarious countries, from the barren tracts of the Bolan Pass, the desert town of Ismailia, and the desert cantonment of Quetta, to the rock-bound soil of Sierra Leone, the Savannahs of the Deccan and Ibadan, and the vast flooded plains of Assam and Lagos. I should be sorry to say that in any of the places seen by me it is impossible to evict mosquitoes over a limited tract of country if only sufficient money were spent. As regards some places—namely, those in which there exists but little stagnant water on the ground—I am convinced that a very small expenditure will suffice for the purpose, while in other places—namely, those where there are large marshes, or numerous pits, wells, ponds, or lakes—the expenditure must be considerable. Here we come to the difficulty which invariably faces the sanitarian—that of cost. In considering the measures to be applied against intermittent fever, we must in the first place make an estimate of the cost. Speaking generally, I am inclined to say that the cost of dealing with the mosquitoes will be far less in the end than the cost of any of the other measures given

above. For instance, in order to protect a single house with wire gauze, we must spend at least £10 or £20. That sum would probably enable us to drain away some hundreds of the small puddles in which anopheles love to breed. In the one case, then, we should spend £10 or £20 in protecting a single house; in the second case in diminishing the number of mosquitoes over a considerable area. To protect a town of, say, 10,000 houses with wire gauze we shall have to expend a very large sum of money, the moiety of which would probably suffice to drain away all the stagnant puddles in their vicinity. The cost of providing quinine to a large population is very considerable when we remember that a staff of medical men must be maintained for the express purpose of seeking out cases of the disease for taking the drug. Segregation means undertaking the cost of building a new settlement, and, as I have said, it will be seen on consideration that in all probability, even in the most water-logged districts, the cost of a campaign against mosquitoes will in the end be less than that of other measures, while I am convinced it will certainly be the most radically effective measure which we can adopt.

It is quite impossible to say here all that can be said on this subject of the various measures which can be adopted against the insects; to particularize where individual measures should be adopted, and where they should not be adopted. I have wished only to make clear to you that if we desire to obtain practical results from recent discoveries we must fix our attention more especially upon measures against mosquitoes. In every way they are really the most promising, and I must remark that they will be just as effective against yellow fever and filariasis as against intermittent fever, and also that they will protect us not only from these troublesome diseases, but from the very considerable annoyance of the insects, which in many tropical countries render life a burden.

In conclusion, I have only to urge that this country and its Government show much greater energy in this connection than they have yet done. Excepting in places like Lagos, the Gold Coast, Sierra Leone, and several isolated spots, I am not at all

satisfied as to the efforts which we have made to give practical application to the discoveries of science. I expected when the mosquito was first inculpated four years ago that the sanitary services of our Colonial Empire would take immediate action—would not spend so much time as they have spent merely in thinking about the matter. I regret to say that I, and many others, have been disappointed in this expectation. Up to the present we see no general wish and no general effort to cope with the disease. Is it true, as is now often said, that we are becoming an unpractical people, incapable of understanding new ideas or of acting on them?

There is at least one comfort. The people in this country are now fully aroused to the necessity for action against intermittent fever in their colonies. They recognise that such action is not only to be of great utility, but also that it is their duty to attend to it. I think that a more general action by Government will not now be long delayed. At all events, I can assure you that if it is delayed much longer, we shall find a means to bring the matter home to those who are responsible for the proper sanitation of our Colonial Empire, and who are neglecting their duties.

THE LIVERPOOL CONGRESS, 1903.

We have much pleasure in announcing that the Right Honourable the Earl of Derby, K.G., late President of the Organizing Council of the British Congress on Tuberculosis, 1901, has accepted the office of President of the Congress of The Royal Institute of Public Health to be held in Liverpool in July, 1903.

THE DESIRABILITY OF APPOINTING A MINISTER OF PUBLIC HEALTH.*

I.

BY

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Medical Officer of Health for St. Neots Urban and Rural Districts.

THE effective sanitary condition or otherwise of all sanitary areas is so nearly related to, and so intimately connected with, the various duties of the sanitary officers attached to them, that the nature of their work, their salaries, tenure of office, and method of appointment, together with many other matters, have not only a very direct bearing upon, and very materially affect, the public health of such areas, but are naturally of much import to the officers themselves—less, perhaps, to those who have already attained to the higher grades of the public health service, but certainly to the general rank and file of health officers of this country.

This being so, before we can correctly gauge the present requirements of the public health service, we must, I think, consider the position of the sanitary officers from several different standpoints, commencing from above downwards.

Taking the senior official first, the appointment of county Medical Officers of Health as consultants upon sanitary matters to the County Councils, which appointments were sanctioned by the Local Government Act of 1894, marked a new epoch in the sanitary work of this country, and is one which should be, and doubtless is, of much benefit to the successful administration and improved condition of all sanitary districts, from the power which such officers possess, through their County Councils, of bringing pressure to bear upon recalcitrant District Councils who refuse to accept the advice or carry out the recommendations of their local health officers.

Such appointments are not at present universal throughout the kingdom, and it may, therefore, possibly be premature to

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* A paper read at the Exeter Congress, 1902.

attempt to appreciate the power for good that lies in them, but sufficient facts are already to hand to enable us to form some estimate.

The relative positions of the county health officers and their local colleagues differ widely. The county officer is the servant of, and responsible to, his County Council, and to it alone. He is entirely independent of any and all of the District Councils within his county, and it is this very independence that constitutes his power for good. He is the adviser of the County Council, which, by virtue of its office, is the paramount sanitary authority for the county, and, should the suggestions made by the local health officers meet with his approval, he can recommend to his Council the advisability of compelling the District Councils to carry them out. Further, as regards any advice to or criticism upon the action of any District Council within his county, however unpalatable the one may be, or however severe the other may appear, the county officer is entirely independent of, and in no way subservient to, any adverse views or opinions which such District Council may hold as to his action, or as to any position which he may consider it expedient to adopt towards it.

Previous to the existence of the County Councils there was no controlling power between the old sanitary authorities and the Local Government Board. Now, however, we have the intermediate agency of the County Councils—in many instances, as I have said, strengthened by a County Medical Officer—and these County Councils have certain valuable powers conferred upon them in respect of the sanitary administration of their counties.

Experience has not yet entirely shown whether these bodies are prepared to act up to the full extent of their powers, but, should they elect to do so, it will be possible that much good sanitary work will be carried out, which otherwise, on account of the bigoted prejudice and supineness of District Councils, and their inveterate obstinacy and dislike to in any way charge the rates for the sake of the public health, would be quite impossible.

Turning now to the local health officer, how different is his

position from that of his county colleague! He is the servant of and entirely dependent upon, his District Council. In a word he can advise any and every thing, but he can enforce nothing. In himself he is absolutely powerless.

District Councils are more than seldom the typical exemplifications of autocratism in its fullest sense, in which apathy to and ignorance of sanitary matters are too often openly manifested. The advice and suggestions of their health officer are listened to with a corresponding amount of polite courtesy and scepticism, but should they involve any change from the old order of things, or, more certainly still, should they necessitate any serious outlay or expense, they are quickly shelved.

As to the mode of appointment of health officers, there is not much to be said as regards the county official. He is elected by his Council on certain terms and conditions, his appointment is a permanent one, and he has practically a free hand.

With regard to the local health officer, however, there is much need for reform. He is appointed by a District Council, or by a combination of similar authorities, subject, of course, to the approval of the Local Government Board, but in the majority of instances the nature of the appointment is most unsatisfactory, and does not in any way tend to the welfare of the district. The appointments are not permanent. In a very few instances they may be made for five years, in some, rather more frequently, for three years, but in the great majority of cases they are made for one year only, with a necessity for re-election at the end of every twelve months.

It is obvious that any such arrangement must place a local health officer in a false and anomalous position, for it is idle to deny that at the end of every year he is, as far as his re-appointment goes, at the mercy of his Council. The fact of his having conscientiously performed his duties is not necessarily favourable to him. It may, on the other hand, be positively subversive of his interests, more especially if any of his work or the advice that he has given has touched the pockets of the ratepayers, and he may very possibly find, from the mere fact of his having done his duty, that he has lost his appointment.

It is clear that to place any officer in such a position is a manifest injustice, because the fact remains that, whether he yields to it or not, the temptation exists for him to shut his eyes to certain matters and requirements in connection with his official duties which, had no such temptation existed and were he independent of his Council, would in all probability have been pressed upon it.

The question of salaries must be discussed under two heads—that of those medical officers who are at the same time in practice, and those who devote the whole of their time to their official duties. In the first, the districts held are generally a small urban or a small rural area, and the Medical Officer of Health is very often the Poor Law Medical Officer and Public Vaccinator. The salaries of such are, of course, small—very often under £50 a year—but the incumbent usually has a good general practice. The official duties are light, and there is not much ground for complaint.

It is with regard to the salaries of health officers who hold combined districts, and whose whole time is devoted to the public health service, that in many cases re-adjustment is necessary. Good salaries are, however, paid in some cases, from £500 to even £700 a year; but there are many others in which the salaries are totally inadequate to the area apportioned and the work required.

Since these salaries were originally fixed, numerous Acts bearing directly upon sanitary work have been passed, and this, together with the vast increase of our knowledge in sanitary science, bacteriology, the causation and prevention of infectious disease, etc., has more than doubled the work of the health officer, without any corresponding increase of his emoluments. I can speak with no uncertain voice on this matter. I have been in the public health service for over a quarter of a century, and have held my present appointment for nearly seventeen years. It comprises one urban and three rural districts, with an area of 175 square miles, stretching thirty-four miles from east to west, and situate in three different counties. I am debarred from private practice. My salary is £262 a year, out of which I have

to disburse the whole of my official travelling expenses; and mine is by no means an isolated case.

One other matter must be alluded to here. I do not think it is well that health officers should themselves be in practice. For several years I was in this position, and my experience has clearly shown me that in such cases duty frequently points one way and self-interest in the diametrically opposite direction. It is a necessary sequence that one of these must go to the wall. I hope and, indeed, believe that in ninety-nine cases out of a hundred it is the self-interest which suffers, and that does not make the situation more desirable. Again, the health officer in practice is in a difficult position in respect of his brother practitioners, whose opponent he is in practice. He has to visit all their infectious cases as a part of his official duties, and, even when the greatest tact has been used, I have seen considerable friction arise therefrom.

As to the third class of officials, the Sanitary Inspectors, the duties of these officers are second only to those of the Medical Officer of Health. They comprise work of great importance, necessitating the possession of certain scientific and technical knowledge which cannot be acquired without considerable study and a curriculum at some recognised institute, or practical work under an experienced chief.

Nothing can be more unsatisfactory or detrimental to the interests of public health than the manner in which Sanitary Inspectors are constantly appointed in rural districts. It is difficult to understand why the Local Government Board permit and approve the appointment of persons as Sanitary Inspectors who have not the smallest experience of the duties attached to such a post, or the faintest rudimentary knowledge of sanitary work. The central authority cannot plead ignorance, for, before any appointment is confirmed, a list of questions is sent down for the appointing council to answer, and included amongst them is one as to whether the selected candidate has had any previous experience in the duties it is proposed he should undertake, and yet, when the answer is in the negative, the appointment is confirmed.

In large towns and cities, where the whole time of the Sanitary Inspector is given to his work, and where he has generally one or more assistants under him, the man selected for such a post would have to give conclusive evidence that he had a practical knowledge of each of the important duties attached to his position, and that he was competent to act in any emergency as a deputy Medical Officer of Health. This is perfectly in order, and as it should be. What I take exception to, however, is, as before stated, the mode of appointment of Sanitary Inspectors in rural districts, in which the action of District Councils calls for the strongest remonstrance.

The salaries attached to these posts in rural districts are always small, and not nearly enough for a man to live on, and, as a natural sequence, they have to be associated with other appointments within the same district—usually that of relieving officer or surveyor, and probably with that of School Board and vaccination officer.

The duties of these different posts, however, lie widely apart in their nature, and a man who is conversant with the one set is usually totally ignorant of the others. What is the result? Particular care is taken by Boards of Guardians not to elect a man as relieving officer or surveyor unless they are satisfied with the evidence he produces as to his fitness for the post. Having secured a man who is really fit for either of the above, the Guardians immediately resolve themselves into a District Council, and proceed to elect the same man as Sanitary Inspector, frequently without asking a single question, assuming that if a man can make roads or undertake Poor Law relief he is a fit and proper person to undertake the trifling duties of Sanitary Inspector, and in a moment to become responsible, under the senior health officer, for the sanitary administration of an urban district of several thousand population, or of a rural area of, maybe, a dozen or more parishes.

I speak advisedly on this point, and from a personal experience of over twenty-six years. During that period nine inspectors have been appointed under me, and it is an absolute fact that in no single instance had any one of the nine any previous know-

ledge of the work. On interviewing them after election, I found that none of them understood what the word "nuisance" meant, either theoretically, practically, or legally. The principles of water-supply, house-drainage, removal of refuse, prevention of infectious disease, etc., were to them unknown quantities. They none of them understood the powers conferred on them; they had never seen the Public Health or any other Act, the provisions of which they had to enforce, and when I read them the list of their duties, as prescribed by the Local Government Board, their condition was one of absolute bewilderment.

Within my own knowledge, during the last six months, two instances have occurred in which men with no sanitary knowledge have been appointed as inspectors, and this in face of the fact that several other candidates in each instance held sanitary certificates.

On what grounds, I ask, can such a procedure be defended? Is it fair either to the Medical Officer of Health or the public that these appointments should be made in such a manner? It would be no one whit less absurd to appoint a solicitor as clerk to a District Council, and then straightway elect him Medical Officer of Health. The duties of the first post he would be certainly qualified to fulfil, and, as far as the latter goes, he would be in no worse position than that of a relieving officer or a surveyor who is turned loose upon any sanitary district as inspector, and undertakes to carry out a series of duties the nature of which is a sealed book to him.

The viciousness of this system lies in the fact that, with the exception of the Metropolitan area and Scotland, there is no law rendering it compulsory that every Sanitary Inspector shall hold a sanitary science certificate, and that the Local Government Board will not insist on Councils paying their inspectors a salary sufficient for them to live upon and give their entire time to their duties.

The inevitable outcome is that the sanitary work is, for some considerable period, only carried out in a most imperfect and perfunctory manner, and the district suffers accordingly; unless indeed, as is generally the case, the inspector's work is supervised

by the Medical Officer of Health, until such time as he has educated his subordinate up to a point at which he can be trusted to act alone in the performance of his duties, a most unfair tax on the senior officer.

After consideration of the defects shown to exist in connection with Sanitary Officers, the question naturally arises, What are the remedies? I would venture to submit that the following conditions should be made compulsory:

1. As regards Medical Officers of Health—
   (*a*) Permanent tenure of office, they being removable only by the consent, or at the instigation of, the Local Government Board.
   (*b*) That Medical Officers of Health should devote the whole of their time to their official duties.
   (*c*) That adequate salaries should, therefore, be paid to them, to avoid the necessity for other work, and for engaging in general practice.
   (*d*) That to render this possible the sanitary areas of the country should be readjusted, small areas to be abolished as separate districts, and areas apportioned which shall in each case be sufficiently large to secure adequate salaries for the Medical Officer.

2. As regards Sanitary Inspectors:

The suggestions (*a*), (*b*), (*c*), and (*d*) shall apply equally to them, with this addition, that no person shall be appointed as a Sanitary Inspector unless he holds a qualifying certificate from a recognised examining Board.

3. As regards both classes of officers:

They should be entitled to superannuation.

Apart from the officers, there are many other improvements that might be introduced into the Public Health service. I allude especially to the lack of county sanitary staffs, to the want of facilities for bacteriological investigation, which should be available for every district. Pathological institutes and bacteriological laboratories exist in Germany, the United States of America, and in many of our colonies. Some of our counties

possess them also, but not many. They should be universal throughout the country. The establishment of permanent isolation hospitals should be made compulsory for each district or combination of districts. Possibly, phthisis should be made notifiable, whilst the filthy and dangerous practice of expectorating in railway-carriages, public vehicles, and other closed compartpartments, should be punishable with a heavy fine. The effectual cleansing and disinfecting of railway-carriages and public vehicles from time to time should be enforced, as it is in several places on the Continent. The enforcement of the vaccination laws should be taken out of the hands of Boards of Guardians, and vested in the Public Health Authorities, and power should be given to Medical Officers of Health to inspect and examine, at will, the scholars of all elementary schools. The housing of the working-classes is also a vital problem, together with the supervision of dwellings, and the condition of our streets demands attention (more especially in respect of their daily pollution), as does that of our open-air spaces. The erection generally of gymnasiums and swimming-baths is desirable. Physical education is of vast importance, and the need for organized teaching of physical health laws, theoretically and practically, is obvious.

Now, I fear, comes the crux of the case. How can all the deficiencies I have pointed out be best remedied? and how can the suggestions made be most effectually carried out? I consider by the appointment of a Minister of Public Health.

At the time of the passing of the first great Public Health Act in 1875, sanitation and the public health service were in their infancy, and the work entailed in connection therewith at its minimum. Now, however, the sanitary service has become a gigantic organization, and the public health work of the Local Government Board has increased to such an extent that it well might, and, I think, should be, resolved into a separate department, with a Minister of Public Health at its head.

The plea for the appointment of such a Minister would rest on the greater influence that would be given to the promotion of public health, and to the consideration of the various matters I have just mentioned. We know that Public Health Ministers

have been appointed abroad, and with very great benefit. In the present Minister for the Colonies we have an example of the effect of a vitalizing personality, and of what a strong Minister can do in one State department. Why should not the same hold good in the public health service? A Public Health Minister—whether at the head of a department or working alone—would have his entire time at his disposal for the benefit of that service. As it is now, those in charge of our public health have other multifarious duties devolving upon them quite apart from sanitary matters, and it is impossible that so much consideration and time can be given to these questions as they require.

I maintain, therefore, that this Congress is fully justified in urging upon the Government the creation of a separate Department of Public Health, with a Minister at its head, such department to have complete control, and upon which shall devolve the entire administration of the public health service of the country, with full power to act on its own initiative in respect of all public health matters, without reference to any other authority or department.

The public health service will then stand on an equality with the departments of agriculture and trade which already possess separate Ministers to look after and secure their interests.

In pressing these points upon you I cannot over-estimate the importance of the assured public health of the population, inasmuch as it is the most valuable asset that a nation can possess. I would remind you that the relative position that any nation bears in respect of other nations is in direct proportion to the condition of the units of which that nation is composed; or, in other words, it depends upon the moral, intellectual, and bodily vigour of its population. The Latin author, Juvenal, has it that nothing tends so much to the perfection of our earthly life as a *mens sana in corpore sano*—a healthy mind dwelling in a healthy body—and it is, I am sure, the constant endeavour of The Royal Institute of Public Health to render such a condition universal.

I have endeavoured, briefly, to point out what I consider are the deficiencies and the requirements of the public health service, and how our ambitions for the cause can best be realized. Not so

very long ago a whisper came across the water that old England had entered upon her decadence, and it was suggested that our race was dwindling under the insidious and absorbing power of the merchant and the manufacturing interest. The policy of universal compromise at one time advocated by certain of the philosophical school of would-be statesmen gave a colouring of probability to the thought begotten of the wish of our enemies. But how do we stand now? The result of the war in South Africa, if it has done nothing else, has at all events given the lie direct to that theory, and has proved that our race is as good as it was in the days of old. It is surely our duty to use our best endeavours to keep it up to that standard. We know not what the future has in store for us, or what lies hid for us in the lap of the twentieth century. It may be that at no very distant date we may have to fight for our hearths and homes, and then the powers of our endurance and the vigour of our population will, of a surety, prove important factors in deciding the issue either for or against us. Let us, then, gird up our loins and strive to do our utmost to promote and foster the health and physical endurance of the rising generation, who, mind you, will become the future mainstay of our nation and the guiders of its destiny, so that they may be able not only to fight the battle of life for themselves, but, if need be, to fight, and under God's hands to fight successfully, for their country and their King.

Great as is our desire that the English nation should be first in arms, first in peace, and first in commerce, let it be our determination to see it also first in public health.

II.*

BY

F. G. BUSHNELL, ESQ., M.D., D.P.H.

The first question that arises is whether the appointment of a Minister of Public Health and the formation of a separate Health Department or Ministry would lead to an increase of the powers for improvement of the health of the community, and I think the

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* A paper read at the Exeter Congress, 1902.

answer hinges on the value of the appointment of a Minister. The reasonable mode of attempting to answer this is by observing the results of analogous action in other operations or departments.

The value of a responsible and authoritative leader in business cannot, at any rate, be disputed. The captains of industry of this country and America illustrate it well. It would be wise if the shrewd business element among us were to realize more fully that national success in commerce must rest ultimately on a sound public health basis. We desire in public health matters to promote progressive measures with efficiency and commensurate with the artificial conditions in which we live and work.

How is this best obtained? In science, in arts, in warfare, in exploration, and in religion, it is the individual who leads the way, for others as a rule to follow.

If this is so, why should there not be a State leader in public health? We are told that Englishmen would never submit to "grandmotherly" legislation as do the Germans. I do not credit this statement for a moment, for it implies in reality that the British public would not know what was best for themselves, and that they were lacking in instinct and intelligence.

This is certainly not the case with the masses of our working population. I believe a poll would show that a large majority are as enlightened as their leaders to the value of most accredited or scientific public health measures, intelligently applied, and are prepared to receive them. Such ignorance as does exist will disappear with improved education. I quote from the *Times* the description of Mr. J. William Whittall, President of the British Chamber of Commerce in Turkey, as showing the alertness of the German consular system, and I think it would not be harmful if the organizations of our Public Health Department resembled it: "The German system reminds me of an army specially disciplined, marching with scientific precision, commanded by responsible and experienced chiefs, who know exactly what they have to do, and the consequences to themselves if they do not do it."

We are told that organized measures destroy individual initiative. I doubt it. If these measures attain their object, this necessary quality must be otherwise promoted. We have an apt illustration of the value of expert medical measures on a national scale in the results of vaccination in Germany. In 1899, in its population of 54,000,000, there were twenty-eight deaths from small-pox, and these occurred in twenty-one separate districts. During the last twenty-five years there has been very little epidemic small-pox in Germany, the Government having twenty-two State laboratories for preparing lymph. In London over 1,500 deaths have occurred in the recent epidemic of the last ten months, 7,500 people have been ill, and the cost of attempting to isolate the sufferers has been over £500,000.

Can we believe that the public would refuse vaccination if they realized its protective value, or if effective legislation was directed towards it?

In America we have similar examples of State initiative to that of Germany in the support from State funds of sanatoria for consumption and colonies for sane epileptics; others are the universal provision of public health laboratories, the compulsory notification of consumption, and in the recent appointment of paid State Commissioners to promote and prepare plans in every State for gymnasia, swimming-baths, open-air spaces in towns, etc.

At home we have a striking example of a vitalized department in the Colonial Office. I am no politician. I believe "politics" to be largely the relic of a crude machinery, necessary in the past to stir up public interest in public affairs, which will be replaced in the future by the application of ordinary business principles of management and government as compared to controversial and partisan ones.

Can we deny that the Colonial Office has worked wonders since it has been galvanized by Mr. Chamberlain? Aided by a widespread national sentiment, it is consolidating our Empire.

Quite recently a leader has been placed at the head of the Department of Education. Is this due to the stimulating words of the last President of the British Medical Association in his

address at Cheltenham? Assuming it is, what may not the leaders of the medical profession do for the appointment of a Minister of Public Health?

The head of the Department of Agriculture has already been of service to the interests of agriculture. At the present time, however, an inspector of this department who recently investigated a virulent case of rabies was not a qualified veterinary surgeon! While much remains to be done, therefore, it is good to see that the Minister is putting himself in touch with practical requirements by a system of local correspondents.

I think that these facts show that the appointment of a Minister of Cabinet rank at least should be seriously and immediately considered, as tending to render the public health and its services better. One may ask, What are the problems to be solved that render such an important step necessary? They are manifold.

Mr. T. Poyntz-Wright has shown, in his interesting paper, the need for organization of the public health services; the housing question needs attention from all aspects; education in the principles that govern health, and instruction in cleanliness in its widest sense both to children and to parents; the provision of public health laboratories for the detection of disease in man and in animals; the protection of the air, the soil, the water, meat and milk supplies; the physical education and medical inspection of scholars in elementary schools (already widely recognised and carried out in America, as Mr. Bracken tells us); the prevention of communicable disease; the promotion of sanatoria for consumptives and accommodation for advanced cases of phthisis, are only a few among the questions that need an answer. This formidable list shows, I believe, that the Medical Department of the Local Government Board has not grown in due proportion to public necessities.

It has evidently been the desire of Mr. Poyntz-Wright to make constructive suggestions rather than destructive criticisms. Such criticism could, of course, in the conduct of any large department, be made—*e.g.*, after several years' consideration the Local Government Board has not yet decided, apparently, whether expenditure

on a sanatorium is legal under the Public Health Act, 1875, Section cxxxi. The Local Government Board cannot be said to lead the way to the prevention of tuberculosis, for they say that tuberculosis is not a disease to which the principles of compulsory notification could be applied in their opinion. Assuredly it will be in force one day, intelligently applied in this country, as it is already with advantage in New York. As Dr. J. Robertson, the Medical Officer of Health for Sheffield, says, "Every great sanitary improvement has to-day to be initiated by a single local authority." Should this be so, what happens if the local authority does not act? Here it appears to me that the State might well step in.

An eminent member of the present Government writes to me that the Local Government Board is equipped with all necessary power; that its energy in public health matters has impressed him very much; that the multiplication of Ministers seems to him to weaken rather than increase their individual weight, and that the effective discharge of public health regulations must eventually devolve on local authorities. Such opinions from a distinguished Privy Councillor show the need for the most careful consideration, but I do think the case needs such consideration. Further, it is the experience of most men that the initiative in public health improvements come, as a rule, from the Board.

I venture, on the other hand, to assert that if this is the case, in the light of what has been said, still more initiative is necessary, and that a Minister of due weight in the councils of the nation might supply this. More than an arbitrator on disputed points or an administrator of what is accepted is required. An advocate and leader is needed as much in State medicine as in the Church, the Law, the Navy, or the Army.

I very strongly urge that all the numerous and important national associations dealing with the public health should be asked to consider and recommend on this important measure, the details of which it would be inopportune, even if it were in my power, to present on this occasion.

RESOLUTION OF THE EXETER CONGRESS, 1902, ON THE SUBJECT OF A MINISTER OF PUBLIC HEALTH.

The following resolution, proposed by J. Poyntz-Wright, Esq., and seconded by F. Bushnell, Esq., M.D., was adopted by the Congress:

> "That in the interests of the public the health services of this country require organization on a system suitable to modern conditions, and that this end would be furthered by the powers and influence for initiative of the Health Department of the Local Government Board being increased, and the Department formed into a Ministry of Public Health."

NOTE.—Since the above papers were read, a comprehensive collection of opinions on the subject has been sought.

Ministers, Members of Parliament, the medical profession, sanitary authorities, the Universities, Colleges of Medicine, legal authorities, associations dealing with the public health, medical and scientific societies, local authorities, hospitals, daily journals, the Egyptian and Spanish Medical Congresses, and persons in Canada, Australia, the United States, and the Foreign Embassies, have been invited to express their views.

At the suggestion of the *Lancet*, a paper will be read at the International Congress of Hygiene in Brussels next September, which will deal with the question, and at which the following resolution will be proposed by me:

"C'est l'opinion du Congrès d'Hygiène et Démographie de Bruxelles que la santé des nations profiterait par l'établissement des Ministres de l'hygiène publique. Le Congrès recommande vivement la considération des gouvernements à la nécessité de les établir."

In order to promote a full discussion, Professor Dr. F. Putzeys, Secretary-General of the proposed Congress, advocates a discussion previous to the meeting in the press and in public health journals. All who are interested in this measure are invited to participate in its full consideration. It is recognised that it must rest finally with the public to adopt sanitary measures, and the proved value of voluntary efforts in the past are acknowledged, but I am convinced that an advocate is needed in all countries, who will initiate and organize all scientific hygienic reforms. In the person of a Minister of Public Health would be focussed the necessary authority, and he would be an educational factor of prime importance in direct touch with and zealously promoting the interests of health both of individuals and nations.

BACTERIOLOGICAL NOTES.

I.

THE PROPHYLACTIC USE OF DIPHTHERIA ANTITOXIN.

BY

R. TANNER HEWLETT, M.D., M.R.C.P., D.P.H.,
Professor of General Pathology and Bacteriology in King's College, London.

EXPERIMENTALLY, the antitoxic sera are found to possess immunizing properties to a high degree. A guinea-pig inoculated with a small amount of diphtheria antitoxin is thereby rendered insusceptible to many times the fatal dose of diphtheria toxin. This insusceptibility is rapidly acquired—within a few hours—but gradually passes off, so that at the end of a month hardly any trace of it will be left. This immunizing property of diphtheria antitoxin is now being applied practically for prophylactic purposes, and as its value becomes more generally recognised, will prove a valuable method for helping to stamp out the disease. The prophylactic use of diphtheria antitoxin is especially indicated where a case or cases of diphtheria occur among susceptible individuals who are more or less closely associated, as, for example, in families, schools, and institutions. Under such conditions, as soon as the primary case is recognised, all those who in any way may have come in contact with it, or, better still, all the susceptible individuals in the institution, should without delay be injected with a dose of diphtheria antitoxin. Many records have now been published as to the efficacy of prophylactic injections as a preventive. Biggs,* the Director of the New York Health Department, states that of 3,100 individuals known to have been exposed to the infection of diphtheria, and injected with a prophylactic dose of antitoxin, only nine contracted the disease, and these in a mild form. The immunizing dose was, however, too small, 150 units, and we give more than this now. The Department of Health of the City of

* *Journ. Amer. Med. Assoc.*, March 17, 1900, p. 695.

New York, with its usual energy, has issued a "circular to physicians setting forth the importance of immunization for the prevention of diphtheria."

From January 1, 1895, to January 1, 1900, immunizing injections of antitoxin were administered in 6,806 individuals by the inspectors of the Department of Health. Of these individuals, eighteen contracted diphtheria of a mild type; one case only of diphtheria complicated with scarlet fever terminated fatally. It is probable that in these nineteen cases an insufficient amount of antitoxin was used to produce immunization.

The records of the Division of Bacteriology show that from January 1, 1898, to January 1, 1900, 682 cases of diphtheria occurred which were secondary to an original case in the same family. Under "Secondary" are included only those cases which occurred at least twenty-four hours after and within thirty days of the primary case. Of these 682 cases, 61 died, a mortality of 8·9 per cent. Had these 682 individuals received antitoxin when the physician first visited the family, probably not one of them would have contracted the disease. The above figures represent only a fraction of such secondary cases occurring in New York City during 1899.

The Board of Health strongly advocates antitoxin immunization in diphtheria. Physicians are especially urged to immunize every child under their care who has been exposed to infection from a case of diphtheria. If this be done it is believed that the number of cases of diphtheria occurring in the city will greatly diminish. To this end the Department of Health offers to furnish antitoxin for immunizing purposes free of charge. When the physician so desires, the antitoxin will be administered by the inspectors of the Department of Health.

The Health Department of Burton-upon-Trent has also issued a circular to the medical profession of the district, emphasizing the value of antitoxin as a prophylactic. In England several examples have been published of the prophylactic value of antitoxin.

Porter* gives some interesting details of an epidemic which occurred in the combined rural districts of Chelmsford and

* *Lancet*, 1901, I., p. 1,753.

Maldon. There were twenty-four families in which cases of diphtheria had occurred. The remaining unaffected members of these families comprised 144 individuals, and to 136 of these prophylactic injections of diphtheria antitoxin were given, and among these a single doubtful case of diphtheria occurred. Of the eight uninjected individuals, three subsequently developed diphtheria. In another series of twenty-four families, no member of which was injected, of 125 individuals, twenty-one subsequently developed diphtheria.

In a convalescent home containing thirty-eight children, three consecutive cases of diphtheria occurred. The remaining thirty-five children were each injected with diphtheria antitoxin (334 units each), and no further case developed (P. B. Blake).*

A serious outbreak of diphtheria occurred in the districts of Cambridge and Chesterton in the autumn of 1900, but by energetic measures of isolation and prophylactic injection the epidemic was stamped out (L. Cobbett).†

With regard to the amount of diphtheria antitoxin required for prophylactic purposes, probably, *as a minimum*, 300 units should be given to children and 500 units to adults; it would be better to administer in all cases at least 500 units.

Although the immunity induced by the injection is rapidly acquired, probably within a few hours, it slowly passes off, and cannot be regarded as lasting for more than three weeks.

II.

BACTERIOLOGY FOR GENERAL PRACTITIONERS AND MEDICAL OFFICERS OF HEALTH.

BY

C. J. RUSSELL McLEAN, M.D., D.P.H.,

Medical Officer of Health to the Doncaster Rural and Tickhill Urban District Councils.

Sterilisers.—A *hot-air steriliser* can be bought for 25s., or, what would be more generally useful, a combined hot air and

* *Lancet*, 1901, I., p. 247.

† *Journ. of Hygiene*, Vol. I., No. 2, 1901, p. 228.

water oven made of copper, brazed (solder will not stand the necessary high temperature if used as a hot-air oven), costing about £2. Neither of these are, however, absolutely necessary if one has access to the kitchen oven after cooking or baking, when the temperature is quite high enough for sterilising dishes, test-tubes, pipettes, flasks, cotton-wool, etc. Cotton-wool should be placed inside a beaker, and when it is slightly scorched the articles may be considered sterile, or, if a thermometer is used, when they have been exposed for one hour to a temperature of 150° C. Remember to let all glass-ware cool in the steriliser before removing, in order to prevent fracture. For a *steam steriliser* for culture media nothing more is necessary than an ordinary medium-sized kitchen pan half full of water boiled over a ring gas-burner, and provided with a potato-steamer, the sides of which may be covered with ordinary felt, in order to conserve heat as much as possible, and the lid, if close-fitting, should have three or four small holes made in it, so that there may be direct circulation of steam. Inoculating wires are best sterilized by holding in the flame of a Bunsen burner or spirit-lamp until red-hot, at the same time passing the glass handle next the wire through the flame so as to destroy any infective matter which might possibly be present on it. The needle should be flamed on every occasion immediately after use, and before laying down.

Incubators.—For a medium-priced and efficient incubator suitable for general work, I can strongly recommend a pattern known as the "Edinburgh," which, with thermometer, Reichert gas regulator, and burner complete, costs about £4, whilst for 8s. or 10s. one may be obtained suitable for the elementary methods to be described. This apparatus should be made of sheet copper (tin soon corrodes and leaks), and in the form of a double pan, one inside the other, with about 1 inch of water-space between the two walls at the bottom and sides, forming a water-jacket. Such an incubator may be obtained of an oval form, but I have had it made *kidney-shaped*, measuring in length, breadth, and height, externally, $15 \times 6 \times 10$ inches, and, internally, $13 \times 4 \times 8$ inches respectively. The inside sizes admit of its holding several

Petri dishes and a number of test-tubes at the same time. If test-tubes alone are being incubated, it is as well to have a movable rack of cross-wires, otherwise the tubes are apt to fall and get mixed up, though two or three small beakers may be used to place the tubes in if preferred.

My reason for recommending the incubator being made kidney-shaped in preference to oval is that the former pattern admits of its being fixed or hung in close contact with the circular hot-water copper cylinders which are present in most houses for hot-water storage for bathrooms, and although the temperature of such a cylinder is a variable one, it is as a rule high enough for the growth of such organisms as the *Bacillus diphtheriæ* and *Staphylococcus;* whilst if no such cylinder is present, or if a higher temperature is required (or, for example, in winter, when much hot water has been drawn off) for the culture of such organisms as *B. typhosus* or *B. tuberculosis*, it can easily be obtained by using a small Bunsen burner underneath the incubator, the temperature in which can be kept at a fixed point by means of a Reichert gas regulator, costing about 5s. The incubator should be covered on the sides and lid with felt, in order to retain heat, and a tubulure provided in the movable but close-fitting lid for inserting a cork and thermometer, another being, of course, made at one corner for pouring water into the jacket; whilst if the jointing be brazed instead of being soldered, the apparatus might be used as a hot-air sterilizer. It can also be used as an "inspissator" for serum tubes if a small dish of warm water be placed inside to prevent the medium drying.

It must be remembered that gelatine medium of the usual strength of 10 or 15 per cent. melts at 24° C. (75·2° F.), so that it is wise not to expose this medium to a greater temperature than 20° C. (68° F.). Agar, which remains solid up to over 40° C. (104° F.), must be employed if the higher temperatures are necessary.

The last article in the list of necessary apparatus is the provision of a good *microscope,* and for those desirous of obtaining a reliable article at a moderate price I would recommend that made by Leitz (Stand II., A), costing, complete, about £15, whilst those

already possessed of one of the older instruments will get perfectly good results by the addition of a $\frac{1}{12}$-inch oil immersion lens, Abbé condenser and Iris diaphragm, for an outlay of about £5 10s.

It is an excellent plan to have a loose sheet of *plate glass*, about 18 × 14 inches, with ground edges, on which to work. By this means the table can be kept free from stains and infective matter, appliances are to hand, and when done working the whole outfit can be removed on it and placed in a cupboard or elsewhere away from curious or careless hands, and if a small room can be reserved for the exclusive purpose of such work so much the better.

Inoculation of Culture Medium.—Culture media in test-tubes may be solidified either in an upright or a slanting position. The former is the one most useful for *stab* cultures, where the straight needle is passed into the substance of the medium; but as the organisms we are to deal with grow best as *streak* or *smear* cultures on the surface of the medium, the slanting position, which offers a larger and easier inoculating area, is the one I should recommend, especially as they can be used for stab cultures if required.

To inoculate a tube it should be held between the first finger and thumb of the left hand, with the slanting surface of the medium pointing upwards, and by keeping the tube as nearly horizontal as possible any germs in the air (which have a weight of their own) are prevented from falling into it. The infective matter, or second tube, should be held between the first and second fingers of the same hand, and, taking the needle high up the handle by the thumb and first two fingers of the right hand, sterilize it by placing in the flame till red hot, then with the little finger and palm, or with the backs of the ring and little fingers also of the right hand, remove the cotton-wool plug from the infective tube by a twisting movement. This screwing motion removes the cotton-wool fibres from the mouth of the tube more thoroughly than would be the case if the plug was drawn straight out. And now, as quickly and cleanly as possible, remove from the infective tube a *very little* of the specimen on

the point of the needle. Plug the tube; remove the wool from the fresh one, and inoculate the new medium by making one, two, or three streaks the full length of the culture surface, and avoid touching the side of the tube. Withdraw the needle; pass the mouth of the test-tube two or three times through the flame, do the same with the plug-end of the cotton-wool, and insert it firmly in the tube. Sterilize the needle before laying down. Label the tube with date and hour of inoculating, and the source of the infective material, taking care not to wet the label with the tongue, as we are dealing with infective matter. Place in the incubator. In the case of *stab* cultures, the infective material is planted by thrusting the straight needle into the substance of the nutrient medium for its full length.

III.

BACTERIOLOGICAL NOTES FROM FOREIGN JOURNALS.

APPARATUS FOR MAKING ANAEROBIC CULTIVATIONS IN FLUID MEDIA. WALTER H. JOLLYMAN, A.I.C.—This is a modification of the apparatus described by Pakes and Jollyman in connection with some experiments on the gas production of bacteria (*Journal Chemical Society*, vol. lxxix., p. 33).

The apparatus consists of a round-bottomed flask or stout bottle (A) fitted with a single-bored* stopper, through which passes a right-angled bend of manometer tube (B). This is connected by means of a piece of thick-walled rubber tubing with another bend of glass tube (C), which passes through a cotton-wool plug into a test-tube or small flask (D); the rubber connection carries a screw or spring clip.

The apparatus having been sterilized by moist heat, the bottle is nearly filled with the medium, about 15 c.c. of which are placed in the tube D; the whole is then sterilized for half an hour on two successive days in the steamer, the clip being left open, and the tube C being drawn up above the fluid in D. On the third day the

* It may at times be advantageous to replace the single-bored stopper by one carrying two tubes, so that steam may be blown through the bottle to expel the air.

bottle is placed in a calcium chloride bath (immersed up to its neck), which is maintained at a temperature of about 120° C., until all the air is driven out (five minutes will suffice to displace 50 c.c. of air); the tube C is then lowered into the medium, and the clip fastened.

To inoculate the medium in the bottle a fluid culture or broth emulsion must be used; the tube C is removed from the test-tube and dipped into the culture; on opening the clip the infected fluid in the tube will be sucked into the bottle, and when a sufficient amount has been transferred the clip is again shut. The condition in the bottle is one of complete anaerobiosis, and the partial vacuum does not exercise any ill-effect upon the growth of the bacteria.

Considerable quantities of fluid cultivations of obligatory anaerobes may easily be obtained by this method, and the apparatus is specially suited to the examination of water for the *Bacillus coli, B. enteritidis sporogenes* of Klein (using milk as the medium), streptococci, etc.

For the examination of water it is convenient to have the bottle graduated, so that a measured quantity of the water can be introduced.

Beiträge zu Bakteriologischen Untersuchungsmethoden. Gabritschewsky. (*Cent. f. Bac. u. Par.*, I., 31; 0, 813.)—The use of heat for fixing bacteria upon cover-glasses previous to staining is known to have an influence upon the power of bacteria in absorbing stains, too high a heat rendering the bacteria incapable of such absorption. The author has tested this property by placing covers of various organisms in a culture oven where the temperature can be kept at a known point, and then testing the staining power of the organisms by subsequent treatment. He experiments with a variety of bacteria, and finds, with some variations, that bacteria colour well if heated to a temperature not over 170° C. to 180° C., that spores will colour when heated to a temperature still higher than this, but that at a temperature of 220°, neither spores nor bacilli will stain. The power of staining by the Gram method disappears at a higher temperature than

that of ordinary staining. In general, if heated to a temperature of over 220° C., the power of absorbing stains is completely lost.

Ueber eine einfache Methode, Bakterien ohne Trocknen an Deck- oder Objectgläser zu fixieren. Von Wendt. (*Cent. f. Bac.*, I., 31; 0, 671, 1902.)—The heating bacteria in the ordinary fixing method undoubtedly produces slight modifications in the organism, so that the subsequent microscopic appearance is somewhat modified. The author has devised a method of fixing the bacteria without the use of heat in order to facilitate the careful microscopic study. The method is briefly as follows: A loopful of bacteria culture is placed in a drop of water or in water containing 3 per cent. nitric acid and one-half per cent. corrosive sublimate. A cover-glass is then covered with a thin layer of Meyer's albumin glycerine fixative, a drop of water is placed upon the cover-glass, and a small amount of the bacteria mixture is placed carefully upon the drop of water with the platinum loop. The bacteria spread through the drop and gradually sink. The whole is placed under a watch-glass for half an hour, when the bacteria will have sunk to the bottom of the drop. It is then placed, still under the watch-glass, in an oven at the temperature of 75° C. for eight to ten minutes to coagulate the albumin. This must be done under conditions which prevent the water from evaporating in order to keep the bacteria moist. The water may then be removed and staining reagent applied, for the bacteria will be fixed by the albumin.

Ueber ein Beifahren zum Nachweis der Typhusbacillen. Drigalski and Conradi. (*Zeit. f. Hyg. u. Infec.*, 39; 283, 1902.)—The authors have devised a method of distinguishing typhoid bacillus based upon a somewhat different principle from any of the other methods used. It is dependent upon the use of a culture medium which especially stimulates the growth of the typhoid bacillus, the essential features of which are the use of a larger per cent. of agar and bouillon than usual, the presence of an alkaline albuminate (nutrose) and of crystals violet B. The medium is made with 3 pounds of chopped beef, 2 litres of water,

20 grammes of peptone, 10 grammes of salt, 20 grammes of nutrose, and 60 of agar. A second solution contains 260 c.c. of litmus solution and 30 grammes of milk sugar. These two solutions are mixed and rendered alkaline, after which 20 c.c. of a one-tenth solution of crystal violet B is added. The typhoid colonies develop readily on such plates, and are easily differentiated by the agglutination test after twenty-four hours' growth. With this material he is able to separate the typhoid bacillus in a large number of cases from the body excretions before there are distinct symptoms in the patient, and in many cases where the Widal test has failed.

UPON A SPECIAL METHOD FOR THE DETECTION OF THE TYPHOID BACILLUS IN THE BLOOD. CASTELLANI. (*Cent. f. Bac. u. Par.*, I., 31; 0, 477.)—This method depends upon a dilution of the blood sufficiently to remove the disturbing factor of the agglutinating bodies. A few centimetres of blood of the patient is added to several large flasks, each containing 30 c.c. of faintly alkaline beef broth. The flasks are incubated at blood heat, and in twelve cases out of fourteen the typhoid bacillus was detected by subsequent study.

OBITUARY.

WE regret to announce the death of Mr. Paul Quick Karkeek, M.R.C.S. Eng., L.S.A. Lond., for many years a Fellow of The Royal Institute. He was appointed Medical Officer of Health for Torquay in 1878 and 1900. When the borough was enlarged by the inclusion of St. Marychurch and Cockington, he became Medical Officer of Health for the whole borough. By resolute perseverance he carried through the bold scheme, of which he was the author, of buying the watershed on Dartmoor, whence came the water-supply of Torquay, and in all sanitary matters displayed great vigour and tenacity of purpose.

CHEMICAL NOTES.

Apparatus for Automatically Controlling the Discharge or Feed of Sewage or other Liquid into Bacteria Beds, or Filters, Tanks, or the Like. J. Graham, Carlisle. (*Eng. Pat.*, 25,893, December 18, 1901.)—The apparatus consists of two chambers, not in communication with each other, and constructed of masonry. One chamber is in direct communication with the channel conveying the sewage to the filters, and contains a valve, which is lifted to discharge the sewage into the filter. This valve is connected by a lever, having its fulcrum on the partition between the two chambers, to a float, heavier than the valve, in the second chamber. When the sewage has risen to a certain height on the filter, it flows into the second chamber through a siphon-pipe, and raises the float until the latter is held by a catch-lever; at the same time the valve is lowered, and cuts off the sewage supply. The valve is kept closed by the catch-level holding up the float until the filter has emptied itself. During this time a second filter has been filling through another apparatus. When the float of the latter rises and is caught by the catch-lever, an electric circuit is closed and acts on an electro-magnet, which releases the first catch-lever and allows the sewage to again fill this filter. When the latter is full, the electric circuit is once more closed, releasing the second float.

Disinfecting Power of Hot Air. Von Schomburg. (*Zeits. Hygiene*, 1902, 41, 167; *Chem. Zeit.*, 1902, 26 [90], Rep. 302.)—Koch's statements as to the imperfect disinfectant action of dry hot air are confirmed; but the experiments show that even the most permanent of the pathogenic bacteria, free from spores, when present in articles of clothing and the like, are completely destroyed within an hour by air at 100° C. if its relative humidity be from 55 to 65 per cent. This condition may be obtained by placing a vessel containing water, not too near the source of heat, in a chamber within which the air has a temperature of 100° C. In such an atmosphere leather articles are not affected, and do not shrink even after an exposure of from six to eight hours. In

the case of dyed fabrics, neither the material nor the colour suffers. The method cannot be applied satisfactorily in the case of bacteria containing spores, because the time required for their destruction is too great, but the case rarely arises in practice.

BACTERICIDAL ACTION OF ETHYL ALCOHOL. J. WEIGL. (*Arch. Hygiene*, 44, 273-294; *Chem. Centr.*, 1902, 2 [17], 1070.)—Ethyl alcohol exerts a bactericidal action only when it contains a certain proportion of water, and when the formation of coarse precipitates is, as far as possible, avoided. Ninety-nine per cent. and 96 per cent. alcohol have no action on dried germs, and this is due to the fact that the proportion of water present is deficient, and consequently the disinfectant is not capable of penetrating the bodies of the bacteria. Absolute alcohol has a perfect bactericidal action if the germs are first moistened in water at a relatively low temperature. The author avoids the formation of coarse precipitates by agitation; these precipitates form protective coatings around the germs, and so prevent the penetration of the latter by the alcohol. The bactericidal action of alcohol is increased by rendering it acid or alkaline.

MICROSOL. G. FENDLER. (*Pharm. Zeit.*, 47, 599.)—Microsol is a new cheap disinfectant, which, in the form of a 2·5 per cent. solution, is employed as a general disinfectant for drains, stables, and similar purposes. It is a green paste having a marked odour of SO_2, and is readily soluble in water. According to the author, it consists of copper sulpho-carbolate, 10 per cent.; copper sulphate, 75 per cent.; free sulphuric acid, 2·3 per cent.; water, 12 per cent. It may be prepared by heating 5 parts of commercial phenol with 6 parts of strong sulphuric acid to between 120° to 150° C., until a portion of the mixture is found to be perfectly soluble in water. After cooling, the sulphophenolic acids thus obtained are dissolved in 10 parts of water, the solution is saturated with copper carbonate and filtered. To the filtrate 75 parts of powdered copper sulphate are added, together with sufficient water to form a pasty mass.

Preparation of Colourless Albuminoids from Coloured Plant Juices. A. Rümpler. (*Ber.*, 1902, 35 [19], 4162-4164.)—From plants the juices of which darken in the air the albuminoids are, as a rule, obtained in a dark-coloured, impure condition. This is especially the case with the sugar-beet, and to obtain the albuminoids of the latter in a pure state, the author has employed the following process: 2 kilogrammes of the pounded beet were rubbed up with as much powdered ammonium sulphate (about 1,200 grammes) as was required to saturate the water present, until the whole of the salt was dissolved. The pasty mass was then pressed in a powerful press, and the residual mass washed by repeated pounding with ammonium sulphate solution and pressing until the expressed liquid was no longer coloured. The mass, which contains the albuminoids, was then quickly and thoroughly mixed with 250 c.c. of distilled water, which had been previously boiled and cooled to 40° to 45° C.; it was then pressed in a powerful press, this treatment being afterwards repeated with ten or twelve successive quantities of 250 c.c. of water. The whole of the solution thus obtained was filtered on to a quantity of powdered ammonium sulphate sufficient to give a saturated solution. This liquid, containing the precipitated albuminoids, was placed in large separating funnels, and, after standing overnight, the lower layer of clear liquid was run off and the remaining albuminoids filtered through perforated porcelain plates, covered with paper pulp, by means of an air-pump. The residue was then washed with ammonium sulphate solution until the wash liquor remained clear, and was then shaken up with some of the same solution in order to disintegrate it. Repeated shaking of the mass with not too large a quantity of water at about 40° C., and filtering through the paper-pulp filter, gave a solution of the albuminoids of which the first portions were of a faint yellow colour, but the last quite colourless. The dissolved albuminoids were then coagulated, either by alcohol, or by boiling, or by some other means.

Proceeding in the above way, the author has separated from the beet two different albuminous substances, vegetable casein (?) and vegetable albumin (?), which he is further examining.

The residue left after removal of the albuminoids can be used for the preparation of the fatty constituents of the beet.

Caffeine in Coffee. Bertrand. (*Bull. des Sciences Pharm.*, (4, 230; *Pharm. J.*, 1902, 69 [1693], 601.)—The amount of caffeine in the berries of *Coffea arabica*, when cultivated in different countries, varies between 0·69 and 1·60 per cent. Of species other than *C. arabica*, the berries of *C. canephora* yield 1·97 per cent. of caffeine; those of *C. mauritiana* contain 0·07 per cent.; whilst those of *C. humblotiana* contain no caffeine, but a bitter principle, *cafamarin*.

Process of Aerating and Preserving Milk. R. G. Nash, Lucan, Ireland. (*U.S. Pat.*, 714,510, November 25, 1902.)—The milk is first partially sterilised by heating to a temperature of 150° to 160° F., and is then cooled to 40° F., and aerated with carbon dioxide, oxygen, or air. The aerating gas is previously sterilized by passing through hot and cold pipes, and then through sterilized water, which, if desired, may contain a flavouring material. The partially sterilized aerated milk is filled into bottles, which, with their contents, are then completely sterilized in the usual manner. 1·5 drachms of "potash" and 3 drachms of sugar may be added to each gallon of milk to prevent curdling.

Filtration Apparatus for Municipal or Commercial Uses. J. P. Keane, Assignor to E. N. Roth, Cincinnati, Ohio. (*U.S. Pat.*, 714,709, December 2, 1902.)—The filtering tank is of an upright wedge form, with perforated sides, and contains suitable filtering material. The tank is connected with an auxiliary side-chamber for holding and delivering the water over and through the entire perforated area. The tank and side-chamber are divided by cross partitions. The filtration takes place laterally through the tank. Two or more of the tanks may have a common side-chamber.

Water Filter. C. P. Simmons, Baltimore, Md. (*U.S. Pat.*, 714,956, December 2, 1902.)—This filter consists of two filtering chambers, connected both at their upper and lower ends by branch pipes to the main-water supply pipe, the discharge pipes leading from the upper ends of the chambers. The valves, which

control the flow of water, are connected to an actuating rod, whereby all the valves may be operated simultaneously.

DISINFECTING APPARATUS. B. M. DAVIS, Los Angeles, and C. E. COOK, Whittier, Cal. (*U.S. Pat.*, 714,785, December 2, 1902.)—An open tube is suspended by a suitable support perpendicularly over the flame of an ordinary spirit lamp and at a definite distance from the flame. Owing to incomplete combustion, formaldehyde or acetaldehyde is formed, according to the kind of alcohol used in the lamp.

A CONTRIBUTION TO MILK ANALYSIS. ADOLF JOLLES. (*Chem. Zeit.*, xxvi., 944.)—The author has found that the albuminoid bodies left in normal milk after the removal of the casein yield a fairly constant amount of nitrogen—namely, 3·22 to 3·85 milligrammes, or 2·6 to 3·1 c.c. per 5 c.c. milk—when treated by his method of estimating albumin, and believes that this fact may aid in forming an opinion whether a given sample of milk is adulterated or not. For the determination, 25 c.c. of the milk are diluted to 75 c.c. with water, and casein precipitated with 5 c.c. alum solution at 40° C. After diluting the whole to 100 c.c., 20 c.c. are filtered off and used for the estimation of the albumin in solution.

EXAMINATION OF HONEY. J. LANGER. (*Zeits. f. angew. Chem.*, 1902, xv., 1041.)—Natural honey may be distinguished from artificial by means of the inverting ferment originating in the salivary glands of the bees. This substance can be precipitated with alcohol, and its effect on cane-sugar observed by means of the polariscope. After being boiled, honey no longer contains this active ferment.

THE HYDROGEN PEROXIDE TEST FOR BLOOD. J. VILLE AND J. MOITESSIER. (*Bull. Soc. Chim.*, 1902, xxvii., 1003-1008.)—The authors confirm the statement of Cotton (*Analyst*, xxvi., 162) that the energy with which blood decomposes hydrogen peroxide varies with the different species of animals. He shows, however, that the acidity of the reagent must also be taken into account, and recommends the use of a solution containing 11 parts by volume of hydrogen peroxide and 0·35 gramme of sulphuric acid

per litre. Thus ox blood, which liberated 1,085 c.c. of oxygen from a neutral solution of hydrogen peroxide, only liberated 905 c.c. from a solution containing 0·25 gramme of sulphuric acid per litre, and 150 c.c. from a solution containing 1 gramme of acid per litre. The proportion of hydrogen peroxide has also an influence upon the results. Thus when 1 c.c. of the blood of a given species of animal is allowed to act upon gradually increasing quantities of hydrogen peroxide, the amount of oxygen liberated at first increases and then diminishes. The proportion of hydrogen peroxide giving the maximum amount of oxygen varies with the different kinds of animals. For example, the maximum yields of oxygen from 1 c.c. of the blood were as follows: Human blood, 960 c.c. of oxygen with 100 c.c. of hydrogen peroxide (11 per cent. by volume, 0·35 gramme H_2SO_4 per litre); horse's blood, 830 c.c. with 100 c.c.; ox blood, 450 c.c. with 50 c.c.; and sheep's blood, 240 c.c. with 25 c.c. The blood of the dog and the goat gave results approaching those given by sheep's blood. As regards the influence of the dilution of the blood, it was found that the addition of 2 to 10 parts of water to 1 c.c. of blood considerably diminishes the amount of oxygen liberated, but that on still further diluting the blood the quantity of oxygen increases, and may eventually exceed that given by the pure blood. In like manner dilution of the hydrogen peroxide solution has a pronounced influence, the amount of oxygen liberated increasing with the dilution. The authors assert that, in addition to hæmoglobin and fibrinogen, blood contains other substances having an action upon hydrogen peroxide, and that they have succeeded in isolating these substances.

The Determination of Iron in Natural Waters. L. W. Winkler. (*Zeit. anal. Chem.*, 1902, xli., 550-553.)—The author recommends a colorimetric method in which ammonium sulphide is used as the reagent. When a little of this is added to 100 c.c. of an aqueous solution, containing 0·1 milligramme of ferrous iron, the solution assumes a deep-brown colour, and the reaction is still perceptible with 0·01 milligramme; with ferric iron the reaction is considerably less sensitive. A very dilute solution of either ferrous or ferric iron is coloured a bluish-green by

ammonium sulphide when ammonia is also present in large quantity. The following solution is required for the comparison test: 0·7 grammes of ferrous ammonium sulphate dissolved in water, 10 drops of dilute sulphuric acid added, and the whole diluted to one litre; 1 c.c. = 0·1 milligramme of iron. This solution must be rigorously preserved from contact with air. For the determination, 100 c.c. of the freshly-drawn water are placed in a glass cylinder, 5 c.c. of hydrogen sulphide water and 1 to 2 drops of ammonia added; 100 c.c. of distilled water are similarly treated, and the above ferrous iron solution added drop by drop, with agitation, until the two solutions have approximately the same depth of colour: this cannot yet be determined with certainty, since the former is brown, the latter bluish-black. To the latter solution 2 to 3 drops of dilute hydrochloric acid are now added, and after decolourization has taken place a few drops of ammonia; sufficient ferrous solution is then dropped in until both solutions have the same depth of tint. Lastly, both solutions are decolourized with hydrochloric acid and ammonia again added; if the colour of both matches exactly the determination is finished: x c.c. of ferrous solution used = x milligramme of ferrous iron per litre in the water under examination. To obtain accurate results, the amount of ferrous iron in the water should be within the limits of 0·3 and 1·5 milligramme per litre; if less than 0·3 milligramme, 500 c.c. of the water should be taken; if more than 1·5 milligramme, a small measured quantity, and correspondingly diluted. Iron in the ferric condition is determined in the same way, after reduction to the ferrous condition by means of hydrogen sulphide. For the determination of both the ferrous and ferric iron, a few c.c. of hydrochloric acid are added to 10 to 100 c.c. of the water, and the whole evaporated to dryness. The residue is taken up with a little water and hydrochloric acid, the solution treated with hydrogen sulphide solution, heated for a few minutes on the water-bath, and filtered, the filtrate diluted to 100 c.c., and the iron determined as above.

The advantages claimed for ammonium sulphide over potassium ferrocyanide or ammonium thiocyanate are that it is more sensitive, and that it obviates the conversion of ferrous into ferric iron.

THE RENEWAL OF THE VACCINATION ACT.

In connection with this subject, the Council of The Royal Institute of Public Health has directed that the following letter should be sent to the President of the Local Government Board, and a copy forwarded to all County Councils and local Sanitary Authorities:

"The Royal Institute of Public Health,
"19, Bloomsbury Square, W.C.,
"*January* 12, 1903.

"Sir,—I have the honour, by direction of the Council of the above Royal Institute, to inform you that they have for some time past had under consideration the various proposed alterations and additions to the Vaccination Act, 1898, which have from time to time been urged upon their attention by resolutions passed at the Annual Congresses of The Royal Institute of Public Health of delegates from the various County Councils, Sanitary Authorities, and others, which have been held in different parts of the kingdom, and which, in view of the necessary legislation on the subject, they venture to bring under your notice.

"1. *As to the Authority to be entrusted with the Administration of the Act.*—The Council agree with what appears to be the universal opinion, that the Boards of Guardians should be relieved of this duty, inasmuch as vaccination belongs to the domain of preventive medicine measures, and is in no way concerned with Poor Law administration. They feel, also, that such a transference will remove what is a real, although withal a sentimental, stigma which is attached to vaccination, and also tend to the appointment of Public Vaccinators selected from a larger body of medical practitioners.

"In the event of this point being conceded, the question arises as to who shall be the administering Authority. Here several alternatives present themselves: (*a*) That the administration should be wholly central—that is, by the Local Government Board; (*b*) that the administration should be transferred to the

Local Sanitary Authorities; (*c*) that the County Councils should take over this duty.

"As regards the first alternative, this would be opposed to the prevalent ideas as to local government, and, for other reasons, appears to be unadvisable; a general supervisory power should alone continue to be vested in this Government Department.

"In reference to the second alternative, there appears at first sight much to be urged in favour of the bodies entrusted with the duties of sanitary administration being the bodies for the administration of the Vaccination Act, inasmuch as vaccination is purely a preventive measure; but such a transference would mean a considerable addition to the number of existing administrative authorities, and it is to be feared that local prejudice and opposition would be encouraged to play a more prominent part in the future than in the past, and a most undesirable element thus introduced into the election of members of the Sanitary Authorities, whilst in rural districts, the personnel of Rural District Councils and Boards of Guardians being practically identical, the transference would be merely a nominal one.

"In the opinion of this Council, the best authorities for the administration of the Act are the County Councils and County Boroughs, and this mainly for the reasons that such bodies will be further removed from the operation of any opposition which may be engendered to the successful working of the Act, that greater uniformity may be expected in the administration, and that these bodies, being entrusted with great powers under the Education Act, will be in a position to more easily administer any revaccination clauses which may be introduced.

"To this general statement the Council would suggest that an exception be made in the case of the Administrative County of London. From national—owing to the intercommunication between the provinces and London—as well as from Metropolitan considerations, it is most desirable that uniformity of administration should be introduced into the Metropolis, and for these reasons, although the Corporation of the City of London and the twenty-eight Metropolitan boroughs might well be assumed to faithfully and energetically administer the Act, it is most

necessary that this duty should be entrusted to a central body. Of these, two already exist in London (for the Water Board need not be considered)—the County Council and the Metropolitan Asylums Board. The former have no direct duties in reference to infectious disease, whilst the latter is intimately associated with it: it receives the notifications of disease, and is in active touch and sympathy with the boroughs in the removal and treatment of infectious cases, and is, withal, in close alliance with the present Vaccination Authorities, and for these reasons the Council strongly feel that the Metropolitan Asylums Board should be selected as the Vaccination Authority for London.

"2. *As to Efficient Vaccination.*—The desirability of vaccination being assumed, the Council submit that it is necessary that a standard of efficient vaccination should be prescribed by the Local Government Board.

"3. *The Necessity for Provisions for Revaccination.*—The experience of this and other countries clearly demonstrates the fact that primary vaccination does not confer life-long protection to the individual, and in this country, consequently, we are subject to periodical invasions of small-pox, whilst the procedure in Germany, where primary vaccination is combined with a system of revaccination, results in such epidemics being practically unknown.

"The Council are, therefore, clearly of opinion that clauses should be inserted in the Bill placing revaccination at a suitable age on the same footing—*qua* the so-called compulsion—as primary vaccination. The Council, in this connection, cannot, however, ignore the possibilities of Parliamentary opposition, and they therefore suggest a procedure, confirmed by the late epidemic of small-pox in London and endorsed with practical unanimity by a representative meeting of delegates from the Metropolitan boroughs, held at the Asylums Board offices on the 7th February, 1902, that powers should be obtained for insisting upon the compulsory vaccination and revaccination of all persons in a dwelling-house wherein small-pox had broken out.

"4. *As regards the Provision of Calf-lymph.*—In this connection the Council are impressed with the necessity, in the interests of

the public and of vaccination, that an assurance should be forthcoming that the lymph used in vaccination is pure and efficient, and they feel that every vaccinator, whether public or private, should be enabled to obtain lymph prepared under conditions which give a reasonable guarantee for this. The Council are of opinion that no distinction should be made between the public and private vaccinator in this respect, that both should be enabled to obtain gratuitously the necessary lymph; for, by the arrangements at present in force, a large number of persons, thinking the lymph from the National Vaccine Establishment more reliable, seek the services of the Public Vaccinator who would not otherwise do so, and an unnecessary burden is thereby imposed upon the rates.

"In furtherance of this object they also urge the desirability of conferring upon the Vaccination Authorities to be appointed by the Act, either separately or in combination, the power to provide laboratories for the preparation of calf lymph, which laboratories might in time be so extended as to afford facilities for the bacteriological and chemical examination for the public health purposes of their respective areas.

"The Council, in venturing to respectfully urge upon your notice these general principles, desire me to add that they have purposely refrained from referring to the many questions of detail which they recognise must be dealt with in the new Act, but, feeling assured that the adoption of such principles as the above is intimately connected with the conferring of immunity upon the country from outbreaks of small-pox, they very strongly press them upon your notice for careful consideration.

"I have the honour to be, Sir,
"Your obedient servant,
"William R. Smith, M.D.,
"President.

"The Right Hon. Walter H. Long, M.P.,
"President, Local Government Board,
"Whitehall, S.W."

In reply to a deputation which waited upon the President of the Local Government Board upon the subject, at which The

Royal Institute of Public Health was represented by the President, Mr. Long said nobody in the Local Government Board office would attempt to dispute either the assertions that had been made in support of vaccination or the gravity which had rightly been attached to its successful performance throughout the country. He believed that the proper line of reform in the matter of the authority to administer the Act was in the direction of centralization, and his own inclination was to make County Councils and Borough Councils the authorities in future. It would be a very great advantage if a well-considered system of revaccination at certain ages could be devised, and it was desirable that there should be a clearer definition of efficient vaccination. The output of the new sterilized lymph raised a very difficult question, and although the vaccine establishment had been much enlarged, it would be impossible to undertake the supply of lymph generally to the whole country, and he would require to be satisfied that the commercial lymph was unsatisfactory before they attempted to embark on so large a business as the supply by Government of lymph for general use. He had had no opportunities of consulting the Cabinet, and all he had sought to do was to indicate the general principles which would guide him in any recommendations he might make to his colleagues.

DIPLOMAS IN PUBLIC HEALTH.

Indian Medical Service Examination, January 17 *and following days.*—C. S. Parker, M.B. Lond.: F. W. White, M.B. Lond.; T. C. Rutherford, M.B. Durh.; D. Heron, M.B. Edin.; L. Reynolds, B.Ch. Cantab.; H. H. Broome, M.B. Edin.; C. G. Seymour, L.R.C.P. Lond.; E. C. Taylor, M.B. Cantab.; D. P. Goil, M.B. Edin.; H. C. Keates, M.B. Lond.; R. A. Needham, M.B. Vict.; J. Kirkwood, M.B. Edin.; A. Whitmore, M.B. Cantab.

University of London, M.D. State Medicine.—W. W. Kennedy, Glasgow University and St. Bartholomew's; T. H. C. Stevenson, B.S., University and Yorkshire Colleges; W. Watkins Pitchford, King's College.

REPORT OF THE COUNCIL.

THE quarterly meeting of the Council of The Royal Institute of Public Health was held at 19, Bloomsbury Square, W.C., on January 21, 1903, the President (Professor William R. Smith, M.D) in the chair. Present: Sir James R. Andrew Clark, Bart., C.B.; Sir Charles A. Cameron, C.B.; F. W. Alexander, Esq.; E. G. Annis, Esq.; H. Beale Collins, Esq.; Colonel H. E. James, R.A.M.C.; G. Millson, Esq.; H. W. Roberts, Esq.; Colonel W. F. Ruttledge, R.A.M.C., Treasurer; and James Cantlie, Esq., M.B., Hon. Secretary. Letters of regret at their inability to attend were read from Sir James A. Russell; P. Bushell Anningson, Esq., M.D.; Professor John Glaister, M.D.; Professor R. T. Hewlett, M.D.; Alexander Johnston, Esq., M.D.; and W. G. Woodforde, Esq., M.D.

The minutes of the last meeting were read and confirmed.

The Finance Committee reported—

(*a*) That they had discharged the mortgage on the premises.

(*b*) That the balance of the General Account of The Royal Institute on December 31, 1902, was £281 11s. 1d., and of the Harben Trust Account £125 14s. 3d.

(*c*) That the balance at the Bank on January 21, 1903, of the General Account, after the payment of all outstanding liabilities, was £565.

(*d*) That they recommended that a sum of £400 be invested on the advice of the Auditor.

(*e*) That a grant of £50 be made to the Library.

The recommendations were adopted.

The Executive Committee reported—

(*a*) That they had appointed Mr. T. C. Hodson, formerly of the Indian Civil Service, Assistant Secretary.

(*b*) That they had approved of a letter to the President of the Local Government Board relative to the policy of The Royal Institute concerning vaccination.

(*c*) That they had addressed the following letter to the Director-General of the Army Medical Service:

"THE ROYAL INSTITUTE OF PUBLIC HEALTH,
"19, BLOOMSBURY SQUARE,
"*November* 6, 1902.

"SIR,

"I have the honour to inform you that the Council have had under consideration the important address delivered by you to the University College Medical Society on October 15, which they have caused to be printed in the

November number of *The Journal of State Medicine*, a copy of which will be forwarded to you.

"The Council are much impressed with the importance of the subject-matter of your address, and are anxious to take effective means to give effect to your wishes. And I am directed to ask if you would be so good as to let them know the lines upon which, in your judgment, these endeavours should be directed.

"I am, Sir,
"Your obedient servant,
"WILLIAM R. SMITH, M.D.,
"*President.*

"SIR WILLIAM TAYLOR, K.C.B., M.D., K.H.P.,
"Director-General Medical Staff."

And had received the following reply:

"WAR OFFICE,
"*November* 13, 1902.

"SIR,

"I am requested by Sir William Taylor to acknowledge, with many thanks, the receipt of your letter of the 6th inst., and to inform you, in reply, that he regrets it is not possible at this time to give the information that the Council of The Royal Institute of Public Health desire, the subject being still under consideration.

"I am, Sir,
"Your obedient servant,
"A. KEOGH, D.D.G.

"WILLIAM R. SMITH, Esq., M.D.,
"President."

(*d*) That they had caused the following letter to be addressed to the General Medical Council:

"THE ROYAL INSTITUTE OF PUBLIC HEALTH,
"19, BLOOMSBURY SQUARE, W.C.,
"*November* 17, 1902.

"*To* THE REGISTRAR,
"THE GENERAL MEDICAL COUNCIL.

"SIR,

"I am directed to inform you that the Council of the above Royal Institute have given very careful consideration to the regulation recently issued by the General Medical Council to the effect that 'every candidate for the Diploma in Public Health shall have produced evidence that, after obtaining a registrable qualification, he has attended during three months the practice of a hospital for infectious diseases at which opportunities are afforded for the study of methods of administration,' and they desire me to respectfully submit to you certain representations which they are anxious should be laid before the General Medical Council.

"As you are aware, this Royal Institute took a very active part in obtaining the registration of Diplomas in Public Health, and since then has urged the need for a high standard of study on the part of candidates for these diplomas. The Council are, therefore, in the fullest sympathy with the object which the General Medical Council have in view—that persons holding the position of Medical Officer of Health should possess a sound acquaintance with all the duties that are

likely to devolve upon them. Nevertheless, the Council feel that there is reason to doubt whether any real benefit cau result from insisting upon this regulation.

"The Council are informed that the regulation means that the pupil should have opportunities of appreciating the chief functions of the Medical Superintendent of an isolation hospital, especially that he should learn how to deal with fever patients while in hospital in relation to their admission, classification, detention, and feeding, nursing, disinfection, and discharge.

"Since all candidates for Public Health Diplomas must be duly qualified medical men, and since all duly qualified medical men must have attended a course of instruction at a fever hospital before they can obtain a qualification to practise, candidates for the Health Diplomas would seem to possess a good knowledge of much that is covered by this recent regulation.

"As regards the administrative duties of a Medical Superintendent of a fever hospital, the Council think that knowledge of such matters cannot well be imparted by lectures, however able, and can really only be acquired by practical performance of the duties, and, from their acquaintance with the administrative Boards of fever hospitals, are afraid that any extra interference with the legitimate duties of the Medical Superintendents may be resented.

"A knowledge of the rules for the admission and discharge of patients can be acquired by study of the printed regulations on those subjects which are to be found in every well-managed isolation hospital, and during the three months which candidates have to pass with a Medical Officer of Health they can acquire a practical knowledge of disinfection which can be supplemented by theoretical instruction during the compulsory course of hygiene.

"In conclusion, I am to ask if the General Medical Council will be good enough to allow a representative from this Royal Institute to lay before them, in further and fuller detail, their views on this important subject.

"I am, Sir,
"Your obedient servant,
"T. C. HODSON,
"*Assistant Secretary.*"

And had received the following reply:

"GENERAL COUNCIL OF MEDICAL EDUCATION AND REGISTRATION OF THE UNITED KINGDOM,
"299, OXFORD STREET, LONDON, W.,
"*December* 2, 1902.

"DEAR SIR,

"I have to inform you that your letter of November 18 with regard to the regulations of this Council for Diplomas in Public Health was considered by the Council on 1st inst., and that I was directed to inform you that the Council adheres to its regulations on the subject.

(Signed) "Yours faithfully,
"J. E. ALLEN,
"*Registrar.*

"THE SECRETARY,
"ROYAL INSTITUTE OF PUBLIC HEALTH."

(*e*) That they had approved of Health Lectures being given in the Metropolitan Boroughs of Holborn, Southwark, and Fulham, and recommended that the following be appointed the lecturers at a fee of £10 10s. per lecture:

Professor William R. Smith, M.D., D.Sc., F.R.S. Edin.; Professor Vivian B. Lewes, Professor of Chemistry, Royal Naval College, Greenwich; Professor E. W. Hope, M.D., D.Sc., Professor of Public Health, University College, Liverpool.

The Council adopted the recommendations of the Executive Committee.

The Harben Nomination Committee recommended the award of the Harben Gold Medal for 1901 to Sir Charles Alexander Cameron, C.B., M.D., F.R.C.P. Irel., Professor of Hygiene in the Royal College of Surgeons, Ireland, and Medical Officer of Health for Dublin; and that for 1903 to Professor Sir Henry Duncan Littlejohn, M.D., LL.D., Medical Officer to the Local Government Board for Scotland, and Medical Officer of Health for Edinburgh, etc.

The Council adopted the recommendations of the Harben Nomination Committee.

The Journal Committee recommended that Messrs. Van Alexander and Co. be appointed advertising agents for *The Journal of State Medicine* for the term of twelve months.

The Council adopted this recommendation.

The following were elected members of the Institute:

As Fellows:

George Hugh Spencer Blackburne, Esq., M.B. Melb., D.P.H. Camb., Medical Officer, West Australia.
Captain Percy Evans, R.A.M.C., M.D., D.P.H.
Captain C. T. Green, A.M.R., M.R.C.S.
Major E. C. Hare, I.M.S., M.R.C.S., D.P.H.
Harold Hutchens, Esq., D.S.O., M.R.C.S.
Augustus John Laurie, Esq., R.N., L.R.C.P. Edin.
T. Stratford Logan, Esq., L.R.C.P. Edin., D.P.H.
J. C. R. Robinson, Esq., L.R.C.P., Medical Officer of Health, Dipwade Rural District Council.
T. H. C. Stevenson, Esq., M.D. Lond., D.P.H. Camb.
C. F. Stovin, Esq., M.A., L.S.A., D.P.H.
Captain W. A. Williams, I.M.S., L.S.A.

As Member:

John Alfred Wright, Esq., Surveyor to the Horfield Urban District Council.

James Cantlie, M.B.,
Hon. Secretary.

January 21, 1903.

PUBLIC HEALTH WORK IN WEST YORKSHIRE.

THE thirteenth annual report of the County Medical Officer for the West Riding of Yorkshire, by Dr. J. R. Kaye, is an interesting and exhaustive work dealing with the sanitary government of a great county during 1901.

Part I., which recounts the work of Dr. Kaye and his staff during the year, should be studied by those who are inclined to oppose the appointment of a Medical Officer by Administrative County Councils under the optional powers of Section 17 of the Act of 1888. Of the numerous directions in which useful work is being done, mention may be made of the systematic sanitary survey of the county, the protection of rural interests in Parliamentary water schemes, the promotion of measures for the restriction and prevention of consumption, the giving of lectures and prizes to Sanitary Inspectors, the establishment of hospital committees under the Act of 1893, the administration of the Sale of Food and Drugs Acts, and the investigation of local water-supplies.

One of the most important branches of Dr. Kaye's department is the laboratory, wherein is undertaken, free of charge, the bacteriological diagnosis of diphtheria, enteric fever, tuberculosis, etc. Each of the 161 Medical Officers in the Riding is supplied by the County Council with a stock of "outfits" for distribution to any medical practitioners who may wish to transmit a specimen direct to the laboratory for examination. The report gives detailed statistics of the results, supplemented by records of scientific value and both medical and general interest. The large number of examinations made respecting diphtheria patients, and the discovery of the bacilli in 35 per cent. of the "convalescents," indicates that the County Laboratory will prove of great assistance in preventing the spread of this disease by persons apparently recovered but still infective.

In Part II. Dr. Kaye gives the vital statistics of the Riding and an abstract of the 161 annual reports of local Medical Officers, The county birth-rate (29·5) is below the average of previous years, and the same applies to the death-rate, which was the lowest recorded for seven years—viz., 16·9 per thousand. The infant mortality was in the proportion of 157 per 1,000 births, and the tables clearly show that the sacrifice of infant life is most pronounced in the mining and industrial centres, where it sometimes reaches over 250 per 1,000 births.

The death-rate from zymotic diseases, excluding diarrhœa, was

only 1·08 per thousand, as compared with a five years' average of 1·35. If we include diarrhœa, which was excessively prevalent during the hot weather, the zymotic death-rate becomes 2·14 per 1,000.

Interesting figures are given regarding the prevalence of scarlet fever, and instructive comparisons are made of its incidence viewed in relation to the hospital accommodation of the various districts.

With regard to diphtheria, Dr. Kaye gives statistics for recent years, showing that there is some steady influence at work producing a greater degree of prevalence associated with a relatively lower death-rate. It is probable that antitoxin, the use of which is rapidly becoming general, may be the explanation of this reduced fatality.

The report deals successively with each of the scheduled causes of death, and many valuable lessons are enforced. In order of numerical importance bronchitis heads the list of death causes, followed closely by heart disease and pneumonia; cancer takes the sixth place. With regard to pulmonary tuberculosis, the death-rate in 1901 was the lowest on record (1·0 per 1,000), and, what is more important, a review of past years' statistics shows that a gradual decline is going on.

Under the head of sanitary work done it is evident that the army of sanitary officials in the West Riding of Yorkshire is busily engaged, and that much remains to be done. The report deals with almost every branch of sanitary work, pointing out deficiencies and indicating lines for future work, including a handy résumé of the new Factory and Workshop Act.

Part III. of the report consists of a detailed account of the work in the County Health Laboratory, to which reference has already been made.

It is evident that the sanitary committee of the West Riding County Council have thoroughly equipped themselves for the great work under their charge, and, to judge by the thirteenth annual report, they have already made no small progress in the right direction.

LECTURE AT SANITARY ENGINEERS' INSTITUTE.

The Institute of Sanitary Engineers announce that on Wednesday evening, February 11, at seven o'clock, at the offices of The Institute (19, Bloomsbury Square), a paper will be read on "The Biological Treatment of Sewage: Some Facts and Figures compiled from Three Years' Practical Working of Bacteria Beds," by J. Freebairn Stow, Fellow, C.E., Mem. San. Inst., F.R.M.S., Surveyor to Uxbridge Rural District Council, to which all interested in the subject are invited.

LEGAL NOTES.

HIGH COURT OF JUSTICE.—KING'S BENCH DIVISION.

(*October* 28, 1902.)

AGNEW *v.* MANCHESTER CORPORATION.

THE facts of this case are as follows:

At a meeting of the Unhealthy Dwellings Sub-Committee (being a sub-committee appointed by the Sanitary Committee of the Manchester City Council) held on November 20, 1900, the Superintendent reported that the privy or water-closet accommodation at the premises owned by the appellant, Agnew, was insufficient, and the following resolutions were passed.

Resolved: That the Town Clerk be instructed to serve notices upon the respective owners of the above-mentioned premises of the time and place at which the above matters would be taken into consideration by the sub-committee.

Resolved: That the City Surveyor be instructed to prepare for the consideration of the sub-committee and the information of the owners plans and specifications of the works to be executed at the premises in question.

At a meeting of the Sanitary Committee of the Manchester City Council held on November 28, 1900, the minutes of the proceedings of the Unhealthy Dwellings Sub-Committee of November 20, 1900, having been read, it was resolved that the proceedings then read be approved and adopted.

At a meeting of the Council of the City of Manchester holden on Wednesday, December 5, 1900, at the Town Hall, being a special meeting of the Council, it was resolved that the proceedings of the Sanitary Committee then read be approved.

On May 13, 1901, a printed circular letter was sent, *inter alios*, to the agents of the appellant by the Town Clerk on behalf of the respondents, in which he was informed that the attention of the Unhealthy Dwellings Sub-Committee having been directed to the condition or want of water-closet, privy, or ash-pit accommodation . . . they will meet on May 21, at 3.40 o'clock precisely, for the purpose of taking the subject into consideration, and, if so determined, of making an order in relation thereto. The appellant was further informed that, if he desired to make any representation or statement to the committee, he was requested to attend the meeting.

On May 14, 1901, the agents of the appellant were informed by the City Surveyor that plans had been prepared showing how the property might be dealt with, and might be seen at the City Surveyor's office.

At a meeting of the Unhealthy Dwellings Sub-Committee of the Council on May 21, 1901, the subject was considered, and it was resolved that it be recommended to the Sanitary Committee that the owners be ordered to provide privies or to make the alterations in accordance with the plans submitted and signed by the Chairman.

At a meeting of the Sanitary Committee of the Council held on May 22, 1901, the minutes of the proceedings of the Unhealthy Dwellings Sub-Committee of May 21, 1901, having been read, it was resolved that the proceedings then read be approved and adopted; and it was further resolved that the owners be ordered to provide water-closets or to make the alterations in accordance with the plans, and that the Town Clerk serve notice upon the owners requiring them to execute

the work within twenty-eight days from service of such order. At a meeting of the Council of the City of Manchester holden on Wednesday, June 5, 1901, at the Town Hall, being a special meeting of the Council, the proceedings of the Sanitary Committee having been read, it was resolved that the same be approved of. It was admitted that there were several different lots of property covered by the resolutions enumerated above, and that on May 21 each plan was explained in detail by the City Surveyor, and considered separately by the sub-committee.

It was admitted that at the meetings of the Sanitary Committee on November 28, 1900, and on May 22, 1901, and at the meetings of the Council on December 5, 1900, and June 5, 1901, there was no discussion of the matter appearing in the minutes.

Notice to carry out the alterations in accordance with the City Surveyor's specifications was served on the appellant on August 12, 1901, and he did not comply with the order, but on September 6, 1901, served upon the Corporation notice of his intention to appeal against such an order.

The appeal was heard by the Recorder of Manchester at the Quarter Sessions on October 5, 1901, and judgment was finally given for the respondents on December 9, 1901.

Against the decision of the Recorder the appellant appealed to the High Court of King's Bench, when it was argued on his behalf that—

(*a*) The Manchester Corporation had no power to order water-closets to be substituted for privies and ash-pits under their local Acts.
(*b*) That, if the Manchester Corporation had such power, such power could not be delegated to a sub-committee, regard being had to Section 70 of the Municipal Corporations Act.
(*c*) And that the order was made in pursuance of a general scheme, and not in pursuance of a judicial discretion applied to the circumstances of the particular case.

The Chief Justice, Lord Alverstone, in delivering judgment, said: There was no doubt that it was intended to give the Corporation the powers which they contend they possess. The question was, Had they been given? The consequences of holding that the Corporation were not authorized by their local Acts to require house-owners to put in suitable water-closets were so serious that he was prepared to give to this legislation as wide a meaning as the words would allow.

As regards the second point, the act of the sub-committee in this case was only a recommendation, and did not become the act of the Corporation until it was confirmed and adopted by the Sanitary Committee, and subsequently by the Corporation when it became the resolution of the Corporation.

The third contention failed because there was evidence on the facts that each case was considered on its merits separately, and because the appellant had failed to avail himself of the opportunity of being heard.

Manchester Corporation Waterworks and Improvement Act, 1867 (30 and 31 Vict., cap. xxxvi.), sec. 42. Manchester Corporation Waterworks and Improvement Act, 1869 (32 and 33 Vict., cap. cxvii.) sec. 34. Manchester order confirmed by the Local Government Board's Provisional Orders Confirmation (Halifax, etc.) Act, 1881 (44 and 45 Vict., cap. lxvi.), art. 1. *Wood* v. *Widnes Corporation* (1898), 1 Q. B., distinguished. *Cook* v. *Ward* (1877), C. P. D. 255, distinguished.

CHANCERY DIVISION.

LEYMAN *v.* HESSLE URBAN DISTRICT COUNCIL.

Section 39 of the Public Health Act, 1875, does not empower an Urban Authority to provide a public urinal in such position as, in fact, to cause a nuisance, even though the Authority *bonâ fide* consider that the situation selected is proper and convenient, and even though the result of providing the urinal may be to obviate an existing nuisance.

The facts of the case are:

The plaintiff was the owner and occupier of a house and grounds at Hessle, near Hull, in the district of the defendants, who erected a public urinal close to the boundary of the plaintiff's property and within 12 feet of his entrance-gates. The urinal was of ordinary construction, with three stalls, and was much used.

The plaintiff complained of the urinal by reason of its position at his entrance-gates, which no member of his family or visitor could approach without passing the entrance of the urinal, and on the ground of its user by the public constituting a serious notice and injury to him in the enjoyment of and property in his house and grounds. He claimed a mandatory injunction against the defendants to compel them to remove it.

The defendants denied that the urinal created a nuisance, and stated that they had erected it under section 39 of the Public Health Act, 1875 (38 and 39 Vict., cap. lv.), and had chosen the site after careful consideration as being "proper and convenient," that it had been erected in response to numerous requests from residents in the vicinity, and that it had obviated more serious nuisances, which formerly occurred continuously. There was considerable conflict of evidence as to whether the urinal was in fact a nuisance to the plaintiff.

The case was heard by Joyce, J., who said: "Upon the evidence this urinal is, by its construction and position, a great annoyance to the plaintiff; there is a material interference with the ordinary comfort and convenience of the plaintiff in the enjoyment of his property. It has been urged that private interests must give way to the public good, but where is that in the statute? There is no legal necessity obliging the local Authority to put the urinal on this road at all. There will be an order compelling the defendant Council to remove the urinal within six weeks."

KING'S BENCH DIVISION.

MCNAIR *v.* CAVE.

Section 3 of the Sale of Food and Drugs Act Amendment Act, 1879, does not empower an officer appointed by and acting under the directions of a local Authority to take a sample of milk at a place of delivery outside the district of the Authority, even though the milk is consigned to a dairyman carrying on business within that district.

The facts of the case are that—

1. The appellant is a Sanitary Inspector for the City of Westminster, and the defendant is a farmer at Shottle Belper, in the County of Derby, who has a contract with Messrs. Pryce and Harris, dairymen, of Craven Yard, in the city of Westminster, for the supply to them of 12 barn gallons of new pure

unskimmed milk daily, to be delivered to them at the Midland Railway-Station in the Borough of St. Pancras.

2. The appellant, acting under the directions of the Council of the City of Westminster, and in pursuance of the provisions of section 3 of the Sale of Food and Drugs Act Amendment Act, 1879 (42 and 43 Vict., cap. xxx.), procured without payment a sample of milk from that supplied under the contract above referred to, at the Midland Railway-Station in the Borough of St. Pancras.

3. The appellant duly divided the sample into three portions, one of which he retained, one he sent to the respondent, and the third he sent to the Public Analyst of the City of Westminster for analysis, who certified that the sample contained 21 per cent. of added water.

Information was preferred by the appellant at the Clerkenwell Police Court, and on April 12, 1902, the information was heard and dismissed by the magistrate.

The appeal against the order of dismissal was heard by the Lord Chief Justice, Lord Alverstone, and Justices Wills and Channell, who dismissed the appeal on the ground that it would require special language to give the Inspector power to act compulsorily outside his district, and the mere introduction of the words, "place of delivery," in section 3, is not sufficient, as they are necessary and desirable in order to enable the Inspector of the district to take the sample at an early stage, thus obviating the necessity of taking the sample at the place of sale. The words, therefore, "place of delivery," in section 3, do not imply that he is to act outside his district.

PUBLIC HEALTH MEDICAL APPOINTMENTS.

Butler, A. G., M.B. Cantab., Health Officer, Gladstone, Queensland.
Dewdney, T., L.R.C.P., Medical Officer, Kingskerswell, Devon.
Fullerton, A. Y., M.R.C.S., Medical Officer, Murrurundi, N.S.W.
Graham, E. A., M.B. Melb., Medical Officer, Deniliquin, N.S.W.
Harper, J. R., L.R.C.P., Medical Officer of Health, Barnstaple.
Harrison, W. A., M.B. Edin., Medical Officer, York, West Australia.
Hutchens, H. J., D.S.O., M.R.C.S., Assistant Bacteriologist, Yorkshire (West Riding County) Council.
Kelly, R. V., C.B., F.R.C.S. Edin., Medical Officer Delegate, N.S.W.
London, J. E., L.R.C.P. Lond., Medical Officer, Coventry Union.
Reid, J. D., M.B. Melb., Officer of Health, Raymond, Victoria.
Sharp, H. S., M.B. Cantab., Medical Officer of Health, Kenwyn, Truro.

REVIEW.

The Prize Essay on the Erection of the King's Sanatorium for Consumption. By LATHAM AND WEST. Baillière, Tindall and Cox, 8, Henrietta Street, Covent Garden, W.C. Price 5s.

This, which is the first-prize essay, is divided into two parts, consisting of (*a*) a discussion of the principles to be followed in the erection of a sanatorium for the treatment of tuberculosis; (*b*) an attempt to carry out these principles by the construction of suitable buildings. There are plans fully illustrating the ideas set forth in the text, and the whole essay is a wonderfully complete summary of the progress in the treatment of tuberculosis. We congratulate the authors on their well-deserved success, and we also congratulate the publishers on the expedition shown by them in printing and publishing the book in three days. The book is, of course, well worthy of consideration by all interested in the subject.

BOOKS, JOURNALS, REPORTS, ETC., RECEIVED.

THE Council desire to acknowledge with thanks the receipt of valuable books and publications which have been presented to the Reference Library of The Royal Institute of Public Health by the kindness of Messrs. Smith, Elder and Co., 15, Waterloo Place, S.W., and Messrs. Cassell and Co., Limited, La Belle Sauvage, Ludgate Hill, E.C.

The following periodicals, etc., have also been received:

The Lancet; The British Medical Journal; The Sanitary Record; The Surveyor; The Medical Times and Hospital Gazette; The Pharmaceutical Journal; The Councillor and Guardian; Albany Medical Annals; Glasgow Medical Journal; Public Health; The Journal of Applied Microscopy; The Journal of the Society of Chemical Industry; Water; The Journal of Tropical Medicine; Sanitary Report of the Punjab, 1902; Vaccination Report of the Punjab, 1902; La Salute Publica; Egésyég; The Onlooker; Medical Officer of Health London County Council Report, 1901; Caledonian Medical Journal; Minutes of the General Medical Council; Scientific Memoirs, Government of India.

Letters, Notes, Queries, etc.

Communications respecting Editorial matters should be addressed to "THE EDITOR, JOURNAL OF STATE MEDICINE, 19, Bloomsbury Square, W.C." *Those concerning business matters, non-delivery of the* JOURNAL, *etc., should be addressed to* "THE SECRETARY, The Royal Institute of Public Health, 19, Bloomsbury Square, W.C."

Communications which have been sent to other journals cannot be received.

Correspondents who wish notice to be taken of their communications should authenticate them with their names—of course not necessarily for publication.

Telephone number of The Royal Institute of Public Health, No. 1614 Central.

Fellows and Members who have given permanent cheques for their subscriptions are informed that a receipt will be sent to them, should they desire it, in addition to their banker's receipts, on application to the Honorary Secretary.

The Journal of State Medicine.

THE OFFICIAL ORGAN OF
THE ROYAL INSTITUTE OF PUBLIC HEALTH.

VOL. XI.] MARCH, 1903. [No. 3.

THE TREATMENT OF SLUM POPULATIONS.

BY

PAUL SWAIN, Esq., F.R.C.S.,

Chairman of the Sanitary Committee of the Plymouth County Council.

I THINK it will be admitted that the housing question divides itself into two very distinct problems. One is, of course, how to provide good sanitary dwellings for the working-classes. The other is how to treat the congeries of people who in all large towns still occupy, and must for some time continue to dwell in, slum areas. I venture to think that this latter problem has not received the amount of attention which it deserves. I shall not waste your time in pointing out what I fear is the fact, that the efforts of municipalities to provide dwellings for the working-classes have not been attended with all the success which we could desire. In fact, I think I may go further and say that in the majority of cases failure has been the result of those efforts. And I venture to think that this failure has arisen to a very great extent from the fact that we have not recognised the character of the populations with which we have to deal. Take the ordinary sequence of events. An unsanitary area has been condemned. Houses have been built elsewhere to provide for the displaced inhabitants. As a rule, partly for geographical reasons, and partly for financial ones, these houses have not been occupied by the people for whom they were intended. The result is twofold. These people either crowd into adjoining slums, or else they get into new houses built for the accommodation of one or two small families. The houses become rack-rented, and in a very short time a fresh slum is created in a new neighbourhood, in many

respects of a worse character than the original ones which had been abolished. This I know of my own knowledge, and it is confirmed in a report drawn up by the Plymouth Committee of "The Housing of the Working-Classes" in February last. The Committee reports as follows: "It is probably true that with regard to a large class of houses, including many small houses, Plymouth is for the time over-built. But these houses are only available for the working-classes we have in view, by being rack-rented. They are not suited for this kind of occupancy, and it is feared that large numbers of such houses now so occupied are rapidly becoming slum property, so that what we are clearing in one part is being created in another." But there is a still further consideration. When you have provided for the decent artisan and the respectable labourer, you have still to deal with a residuum which knows not what decency and cleanliness means. Provided you could possibly rescue these people from their degrading surroundings, and put them to live in palatial residences, before six months had elapsed they would have reduced their palaces to hovels. Anyone who has any experience of "model" dwellings for the poor will confirm this statement. It is, then, worse than useless, even if you were able to accomplish it, to transplant this decadent mass of humanity from their congenial surroundings of squalor and misery to the serene atmosphere of municipal houses, built on the approved and extravagant system of the Local Government Board. What, then, is your alternative? I reply, Make the best you can of a bad bargain. Instead of abolishing your slums, reform them. And your reform must be on two lines—reconstruction and firm control.

Many of these houses occupied by the slum populations are good and sound so far as their shell is concerned. Internally they are wrecks. For a comparatively small sum they can be repaired. With a little ingenuity more light and air can be admitted. Sanitary arrangements, not forgetting wash-houses and baths, can be added. Even in some cases it may be possible to found clubs and recreation-rooms for the benefit of the inhabitants. This is no romantic idea. It has been realized and put into effect by the hard-headed Scotchmen of Glasgow.

In a most interesting account published by the Glasgow Workmen's Dwellings Company, entitled "Some Experiments in Housing," you will find set down in black and white the methods and the results, financial and otherwise, of the work done in that city.

I say, then, it would be cheaper and more practical for municipal bodies to acquire slum properties and to utilize them as I have indicated than to spend huge sums of money in building houses for the working-classes which hitherto have proved gigantic failures. But such an investment would be an equal failure if it were not worked on my second line, under firm control. And here, of course, is our difficulty.

Councils have plenty of powers, but in many cases they have neither the hearts or the consciences to put them in force. I am fortunately placed in Plymouth. We have there a County Council fully alive to the necessities of good sanitation. We have made during the last three years large demands on their generosity, which they have never failed to comply with. And amongst the first requisites I would place a sufficiency both in numbers and ability of sanitary inspectors. Still beginning, never-ending supervision is the absolute necessity. And I cannot too strongly advocate the appointment of some women as inspectors. A good woman, backed by authority, can work untold good amongst the most degraded of her sex. How to clean the room, to cook the victuals, to feed and dress the children—all these things come within her purview. They all tend to humanize, to educate upwards, to say nothing about the saving of human life. We are converted to a woman inspector at Plymouth. I only wish we had four instead of one.

I have appended to this paper the admirable printed directions drawn up by our Medical Officer of Health, upon which our woman inspector acts. She is by degrees becoming a *persona grata* to the women of the slums.

There must also be a fearless and impartial treatment of all slum landlords. There are landlords and landlords. Some there are who by unfortunate inheritance or by deterioration of their property have become possessed of slums. I expect few of

this sort ever make them pay. On the other hand, there are men who lay themselves out to become possessors of this sort of property. They deliberately assume their responsibilities, with a view to make the most they can out of their bargains. On such municipalities should have no mercy.

Medical Officers of Health, if they hold, as they should do, independent positions, sanitary committees, and sanitary inspectors, should all conspire to have the uttermost farthing out of the pockets of the possessors of the many "Bleeding Heart Yards" that verify Dickens' descriptions in our large towns. I make every allowance for the difficulties of a slum landlord, but having done so, there remains the fact that he has assumed his position with a full knowledge of what he has to encounter, and with the deliberate intention of making his pile out of the miserable and degraded people from whom he extorts his weekly rentals. The worst of it is that when we have forced such a man to spend his money in sanitary repairs he immediately raises his rentals to cover his expenditure. Municipalities should have some power to prevent this extortion.

When you have done your best you will still have left on your hands what I may term a residuum of the residuum, the hopelessly irreclaimable. They cannot be allowed to remain as plague spots on the community. They must be harried, driven out from one den into another, until they are finally disposed of either in the gaol or the workhouse. It is much to be desired that the time may soon arrive when some practical legislation will enable municipalities to establish inebriate homes to which the habitual drunkard can be committed. It is needless to say that the principal source of all the misery with which we have to contend arises from the drunken habits of the people. All the social efforts which have hitherto been made have done comparatively little to amend this evil. The habitual drunkard should be treated as an insane person, and placed, like any other mad man or woman, under restraint, and that for a very considerable period. If you were to close half the public-houses in the land to-morrow you would still have the habitual drunkard in your midst.

I have one more suggestion to make. The good work which has been done at Glasgow has been carried out, not by municipal effort, but by private enterprise. It has been successful, and has been described as philanthropy plus 4½ per cent. That is to say that a Limited Liability Company with a capital of £40,000 has been able to effect wonderful reforms and pay a dividend of 4½ per cent. to the shareholders.

It is an admirable example of what may be done by private effort. Although it may not be possible to imitate this example in many places, yet it is quite feasible in all large towns to combine private effort with municipal authority. Why should not the various parochial organizations and philanthropic societies ally themselves with the municipal officers in their work amongst slum populations? I have no time to enter into details; I can only throw out the suggestion. I can conceive an alliance between the district visitors and the corporation inspectors, especially the women inspectors, which could only work for good. District visitors would be organized and instructed for their work, inspectors would be helped by information and reports. The alliance would confer on the visitors a *quasi* authority, and a healthful stimulant and encouragement to the inspectors in the hard and thankless office they have to perform would be created.

BOROUGH OF PLYMOUTH.

DUTIES OF FEMALE HEALTH VISITOR.

1. To carry out and exercise the power and general duties of an Inspector of Nuisances.

2. To execute the provisions of the Food and Drugs Act, 1875, and the Acts amending the same.

3. To carry out the provisions of the Acts of Parliament, bylaws, and regulations relative to the government of houses occupied by members of more than one family.

4. To visit and inspect workshops and places where women are employed, and to execute the provisions of the Act in force affecting the same.

Her duties further comprise visiting from house to house in the poorest parts of the borough, calling attention to the necessity for cleanliness of the house and its surroundings, giving advice as to the rearing of children and the nursing of the sick, distributing and explaining handbills on the prevention, etc., of infectious diseases, and reporting daily to the Medical Officer of Health.

F. M. WILLIAMS,

Medical Officer of Health.

THE HOUSING OF THE WORKING-CLASSES.

BY

J. W. SPEAR, Esq., M.P.

I venture to affirm that there is no subject more pressing, or which demands more urgently the attention and skill of statesmen, than that of the housing of the working-classes.

Our villages and small country towns are rapidly becoming depopulated, while the strong and virile population is flocking to the crowded courts of the larger towns, rendering the struggle and the overcrowding even more keen and demoralizing. Of the evils to which this leads we, alas! know too much. There is no need for us to dwell on the gradual but sure degeneration of the race—on the gradual loss of stamina, of physical and of moral health. All this is well known. The great problem is how to cope with the evil which exists to so terrible an extent in towns, and to a lesser extent also in rural districts. Private enterprise and philanthropic methods can do something—but cannot, unaided, do more than touch the fringe of the question. The State has, then, a duty before it. We should, however, be careful that in the administration of State aid we do not check or throttle private enterprise. Of this I have, however, little fear, because the private builder, unhampered by the exacting conditions as to structural requirements demanded by the Local Government Board, can erect buildings at a less cost than can the public bodies. It is essential for the well-being of the country that the workers should be housed in sanitary dwellings, that they should have sufficient air-space in which to breathe freely, and that the densely crowded tenements, deficient in everything calculated to produce health, decency, or morality, should be replaced. Our municipalities and local governing bodies have had extended to them powers both to build houses and also to assist the occupiers of small houses to become the actual purchasers. While good work has undoubtedly been done through the exercise of these powers, one is bound to admit that the failure to cope with the real evil is very marked. The difficulties which have led to the

failure may be partly due to natural causes and partly to the artificial conditions with which the powers of the local bodies are hedged and hampered. It may, I think, be taken as a fact that a large number of the workers in town are compelled to reside near their place of employment. This naturally results in the diminution of the size of their dwellings, with, at the same time, an increased rental, because of the greater value of the land upon which the dwellings are built. Hence, while in rural districts you may have the detached cottage which gives place nearer to the town to the semi-detached two-story building, in the heart of the large town the same amount of land must accommodate the loftier building, or the back-to back tenement let in single rooms.

It is practically impossible for private venture, considering the value of land, the increased value of material, and the increased charge for wages, to produce sufficient buildings, in all ways satisfactory, which can be let at a rent proportionate to the wages earned by an artisan, and more especially by the unskilled labourer, and which will at the same time return such interest on the capital invested as will encourage building to a sufficient extent to meet the need. The obvious deduction is the purchase by the local authority of land when obtainable in the country. Here buildings can be erected at a considerably less cost, because of the lower value of the land. This, however, necessitates the provision of much more regular, constant, and rapid transit from the centre to the outskirts. I should therefore strongly advocate that in all cases where municipalities are engaged in street improvements due care should be taken to work not only with an eye to the improvement of the immediate locality, but that each improvement should be part of a whole, the whole tending to the opening up of definite and easy modes of ingress and egress from the town.

Our municipalities and other local governing bodies are showing themselves keenly alive to the question, and, in so far as their powers permit, are doing all they can. Much has been done in the clearing away of many centres of dirt, disease, misery, and their attendant vices. They have been replaced by wholesome

healthy homes. But in the clearing and renewing, as a rule, there must be accommodation provided for a smaller number than are dispossessed. It thus happens that the very poorest, the men and women in only casual work, and those earning but small wages, the very class unable to pay the increased rentals, or the cost of journeying from and to the suburbs, are rendered homeless. This results in a greater and denser overcrowding still in another area, and carries in its train an accentuation of all the evils. It is surely this class which really needs attention.

Is it not desirable that some less expensive houses than those required by the Local Government Board should be allowed to be erected by the local governing bodies? These would probably be occupied by the people who had hitherto dwelt in slums. Would not this be calculated to gradually lead them to desire the better houses still? I would also suggest that the fullest power should be given local bodies to erect dwellings simply in accordance with their own bye-laws.

Among the artificial barriers which hamper the work of the governing bodies I would place the time allowed for repayment of loans. I have recently had opportunities of giving evidence before a Select Committee of the House of Commons on this point. I suggested that the time of repayment should be sixty years at least, and I pointed out that if the sinking fund were so altered in accordance with this suggestion the relief on a house costing, say, £250 and land £50, would be about 9d. a week. I pointed out two examples of the way in which the present system deters the necessary provision for men of a certain class. Quite recently in Plymouth two men, both in steady employ and earning 19s. a week each, desired houses. They were married men, but had no family. The cheapest house they could obtain contained two rooms and a scullery at a weekly rent of 4s. 6d. The extra 6d. means much. The rent of houses of this class in Plymouth—houses built by the Corporation—has been raised in some cases 6d. and in others 9d. a week, because of the fact that the Committee found the loss was too great. Other cases I could cite, showing the terrible struggle and sacrifice made by men to pay the heavy rent demanded under present circumstances.

Private enterprise and philanthropy have been somewhat checked since the responsibility of providing houses has to an extent been placed on the municipality, and yet, owing to the natural causes to which I have referred, coupled with the short term allowed for repayment, municipalities can only let houses at a prohibitive rate, or else make a heavy charge upon the rates. Extension of the loan-time of repayment would allow corporations already owning houses to materially reduce the rentals, and would encourage further provision of houses.

But while the question is not so pressing in rural districts, it is there, too, a sad factor. Of course, in rural districts the landlord generally feels the responsibility of providing cottages for his workmen. But there is a class of people who have no claim on the landowner. The casual labourer, and frequently the village tradesman, find difficulty in obtaining houses. I certainly think that money ought to be obtainable on loan on sound commercial principles, which would enable houses to be provided for these people at suitable rentals. It is practically impossible for the private individual to build a modern cottage as a commercial speculation in even rural districts which he can let at a rental within the means of the people in question. There is no doubt that part, and a terrible part, of the overcrowding in our towns is due to the waning of interest in rural life and rural pursuits. The fascinations of town life, the excitement of the crowd, the laudable desire to better one's self, the idea of increased pay, all tend to draw the workman away from the land and send him to the town.

Has not also our system of education tended to incite young people to flock to the towns rather than to make them ambitious of excelling in rural pursuits? I am hopeful that in this respect our educational system will be re-cast, and, while giving every opportunity to the clever lad to rise to the highest honours, it will be made more practical, more useful, and will do something to enhance the value of the work performed in rural districts. The constant migration increases the competition in the towns, and it further enhances terribly the housing question there. Apart from the duty of private owners, the claims of philan-

thropy, the duties of the municipality and the State in providing suitable homes, surely something can be done to make rural and village life more attractive. One again desires to hear the ring of the anvil in all our villages, and to see once more the mechanics' shop in full work. Agriculture is heavily burdened. The fall in prices and the burdens on the land prevent more than a bare living accruing from its cultivation. The healthy surroundings of country life do not offer the compensation for the higher wages in our town. The farmer cannot pay more. May it not be that when the whole incidence of our rating is properly readjusted, and when the unfair burdens pressing on our largest industry—burdens equitable and just at earlier periods—are to an extent relieved, that we may see a returning prosperity to a languishing industry? Should this so be, its natural result will be increased labour and increased pay in rural districts, which will be the strongest power in the re-peopling of those districts. Unless life can be made more attractive in country districts we must look to a continued depletion of its population, to a further drifting to the towns, to the sad and sure degeneration of the population.

Surely the ventilation and discussion of these points is of the greatest moment. The remedies should be sought for and should be applied by our statesmen. It is a question which should deeply appeal to men of all parties, and classes, and creeds, apart from party difference, and with no desire to obtain party advantage.

IT is announced that Professor Koch, accompanied by Drs. Neufeld and Klein, has proceeded to South Africa to inquire into the epidemics—notably red-water—which are causing so much havoc among the cattle of Rhodesia, and to advise remedial measures.

SOME OPINIONS AND CONCLUSIONS ON THE HOUSING OF THE WORKING-CLASSES.*

BY

HENRY TOZER,

Vice-Chairman of the Housing Committee, City of Westminster Council.

IT may be rightly said that the housing question arises out of the duty of all proper government, whether Imperial or municipal, to bring the greatest happiness to the greatest number.

Where the duty of individuals has failed in providing sufficient housing accommodation for the labour employed (for it has not yet been universally recognised by employers of labour in town or country that it devolves upon them, and is to their immediate interest, even as a profitable and safe investment, to provide accommodation for their employés at a reasonable rent) it becomes the duty of the Sanitary Authorities to supply the deficiency.

There exists a direct mandate to this effect from the King. Parliament, in the Act of 1900, which embodied some fourteen previous statutes, and with which, I presume, you are more or less familiar, has imposed upon Borough Councils the task—although it has not yet been made compulsory—whilst politicians and political economists of every shade of opinion have urged public authorities to deal in their respective spheres with this pressing and puzzling problem. Its urgency cannot be denied except by those who have only a surface acquaintance with the subject, or whose prejudices prevent a fair-minded and thorough examination. Statistics are too strong to be ignored, and show incontestably the necessity of systematic dealing with the present condition of working-class housing. It is more than a necessity—to-day it is an evil; to-morrow it may become a peril.

MUNICIPAL TRADING.—The academic question is often raised as to how far municipalities should take upon themselves what may seem to be the duty of traders, and the definite expression of a principle has often been invited.

* A paper read at the Exeter Congress of The Royal Institute of Public Health, August 25, 1902.

Is not this the right axiom, that municipal trading is justified and is advisable where such things as are vitally necessary to the health and well-being of a community are inadequately provided by private enterprise, whether it be water, public lighting, tramways and other locomotion, housing of the poor, or other things?

As long ago as I can remember taking an interest in public questions the housing problem existed in Devonshire in regard to the agricultural labourer, and many of you may recollect the acute controversy of some forty years ago, led by Canon Girdlestone, which had no very satisfactory result. The question was practically solved in the course of time by the labourer leaving the land to a great extent, and this may be said to have been one of the principal causes why agriculture became in England a gradually declining industry. As true to-day as it was then is the saying that "You cannot expect men to act like Christians when they herd like pigs."

Town versus Country.—Our cities and towns have so long attracted streams of labour from rural districts that proper housing of the working-classes has fallen below its requirements, even from the health point of view only. So it is that in many large centres of population we are to-day face to face with the difficulties of this housing question. Our commercial supremacy, which depends in a great manner upon our raw labour, is seriously threatened, and it behoves us, *inter alia*, to "wake up" to the necessity of labour being properly sheltered. Our factories and workshops have been vastly improved, labour has in many respects been beneficially organized, but it must be admitted that generally the homes of the working-classes do not come up to the modern standard of comfort and health. This must prejudicially affect the physique of the labourer, and deteriorate the quality of his labour, besides which overcrowding is admittedly one of the main causes of intemperance.

High Rents.—In every city there is a natural tendency for workmen to concentrate as near their labour as possible, and the demand for decent homes being in excess of the supply, the rents become abnormally high, and, as a partial consequence, land

becomes prohibitive in value for the purpose of erecting workmen's dwellings.

Cheap Locomotion.—This concentration can only be obviated by what is now universally recognised as the first important step in dealing with overcrowding—cheap transit to outer parts of towns, so inducing large numbers of the working-classes to go further afield, and relieving the congestion in the populous centres of the towns. A cheap and efficient system of locomotion offers, as has been well said, the most immediate and least experimental—although not complete—solution of the housing problem. Build only where you can make the dwellings self-supporting, for philanthropy should not be an essential part of any scheme. Unless you can buy your land cheaply, you will defeat its success.

But where insanitary or undesirable sites are cleared at the expense of a municipality, and the land used for erection of dwellings, only the value of the land for such purpose should be charged against the housing scheme, and any excess of cost should be considered as civic improvements, and charged to an improvement fund. Still, this method should only be sparingly and conscientiously—certainly not invariably—adopted.

Desirable Land.—How to acquire land at a price that will enable you to provide attractive homes at fair rents is a matter that must be dealt with according to individual circumstances. But, as some guidance, I may mention what the Council of the City of Westminster has recently done. They went to the Ecclesiastical Commissioners, who possessed a large site in Westminster, and said: "Will you help us to deal with the housing difficulty by selling us the land at so much a foot?"—some 40 per cent. below its value for commercial purposes, but still a fair price; and be it said to the credit of the Ecclesiastical Commissioners—who are not, as you are aware, constituted for the dispensation of charity—they consented subject, of course, to fair conditions. What was done in this instance can be done in other cases, although perhaps in a different way, according to circumstances.

And now as to some details of the various workmen's dwellings

that have been erected in late years, which may be summarized in three classes—viz., lodging-houses, block buildings, cottages, the first of which I do not propose, in the short time at my disposal, dealing with, for they are only erected in thickly populated towns, where there is a large class of unmarried labourers, earning scanty and irregular wages. The Rowton House System seems to form the most complete measure of provision for this class, and has met with great success.

Block Dwellings.—Block dwellings are built in towns or urban districts where the high value of land does not permit of cottages being erected, so as to produce a reasonable rate of interest on the outlay at the low rents which the average working man can afford to pay. They are usually built from three to six stories in height, according to the locality and cost of land.

There are two varieties of tenements in block buildings—namely, "self-contained" and "associated." A self-contained tenement is one which has a w.c. and scullery or laundry of its own. An associated tenement has the use of a w.c. and laundry in common with one or more tenements, and also the use of a tap for drawing water when the laundry is occupied. Associated tenements are only built by bodies such as the Guinness Trust, the Peabody Trust, and those municipal corporations who desire to house the lowest paid class of wage earners. It is to be regretted that all corporations do not hold the view that the poorest have the first claim on their attention. It is possible to let an associated tenement at 1s. to 1s. 6d. less rent than can be charged for a self-contained tenement.

Tenements may consist of a single room; a living room and one bedroom; a living room and two bedrooms; and occasionally a living room with three or four bedrooms, with the w.c. and laundry accommodation just mentioned in addition. The proportion of each kind of tenement naturally varies with the locality and the class and means of the persons to be housed.

The tenements of all block dwellings are entered from a common staircase or from an outside balcony. The latter is an objectionable feature, as it becomes necessary to pass a neighbour's windows before arriving at one's own entrance. The more

tenements that are grouped round one staircase, the cheaper is the building to construct. The smallest number of tenements on each floor entered from one staircase that I have seen is two, and the largest number is seven.

Tenement Interiors.—It will probably be of interest if I describe a tenement in detail, avoiding as far as possible technical language. The living room should be provided with a food cupboard, divided into two parts; the upper part, being for the storage of food, should be properly ventilated. The lower part can be utilized for storage of household utensils, but in the case of an associated tenement (where there is no scullery), a portion of the lower part should be reserved for coals. A dresser or rows of shelves with cuphooks thereon should also be provided. The range now generally in use, though varying slightly in design, is of the kind known as a self-setting close range. This is a great preventive of smoky chimneys, as there can be no down-draught. Either an iron or a wooden mantel surrounds the range.

In planning the living-room, care should be taken to provide a space for a bed in case of emergency, and the doors into the bedrooms should be so arranged as to afford proper ventilation of those rooms without destroying the comfort or utility of the living-room.

Each bedroom should have a register stove, which, although only used in cases of illness, affords an efficient means of ventilation at times when no fire is needed.

A dress cupboard or a row of clothes pegs are usually supplied in every bedroom. The former is far preferable, as the clothes are kept clean and the room presents a tidier appearance.

The laundry or scullery of a self-contained tenement should contain a washing-trough, an independent copper in which to boil clothes, a coal-bunk, and, if possible, a small gas cooking-range. The latter is a great convenience, as it enables a tenant to cook during the summer without lighting a fire in the living-room. Lines on which to dry the washing should also be provided in each laundry.

The laundry of an associated tenement should be fitted with a washing-trough, a rinsing-trough, and a copper and drying lines,

but no cooking stoves. It is generally arranged that each tenant has the sole use of this laundry for at least one day a week, and may lock it up to prevent theft of clothes whilst drying. If the other tenants require water, they obtain it from the tap on the landing previously referred to.

The w.c. does not require any description beyond stating that it should be entered either from an open balcony or from the staircase landing.

Cottage Dwellings.—Cottage dwellings may be roughly divided into two classes: (1) Cottages containing one tenement only, to be occupied by one family; (2) cottages containing two or more tenements.

The first class are usually two stories high, and the accommodation provided consists of a living-room, kitchen, scullery, w.c., and three or more bedrooms, and a small garden at the rear.

The second class may be either two or three stories high, containing one tenement or flat on each floor. The accommodation in this type of cottage is similar to that supplied in block dwellings —viz., a living-room, scullery, w.c., and one or more bedrooms; but there is no doubt that the greater privacy obtained by having a separate access to each tenement, and the absence of many flights of stairs, render cottage dwellings more attractive than block buildings. Another attractive feature is the provision of a garden for each tenant.

I must, however, again remind you that it is absolutely impossible to provide this type of dwelling in commercial centres, owing to the great cost of land.

The fittings in cottages are of the same design as those described for block buildings.

London Dwellings.—It will be interesting to give a few particulars of the average areas of rooms adopted in London by some of the bodies engaged in housing the working-classes, and the rents charged by them. I have only included two-room and three-room tenements, as they form the best basis for comparison, the greatest number of tenements erected having been of these two types.

TWO-ROOM TENEMENTS.

	London County Council.		Guinness Trust.		Four per Cent. Industrial Dwellings Company.		Westminster Council.	
	Area.	Rent.	Area.	Rent.	Area.	Rent.	Area.	Rent.
	Feet.		Feet.		Feet.		Feet.	
Living-room -	153	7s. 6d.	141	4s. to 5s. 6d.	176	5s. 9d. to 7s. 6d.	154	6s. 6d. to 7s. 6d.
Bedroom - -	105		127		130		117	
Total -	258		268		306		271	

THREE-ROOM TENEMENTS.

	London County Council.		Guinness Trust.		Four per Cent. Industrial Dwellings Company.		Westminster Council.	
	Area.	Rent.	Area.	Rent.	Area.	Rent.	Area.	Rent.
	Feet.		Feet.		Feet.		Feet.	
Living-room -	157		155		176		154	
Bedroom - -	96	10s. 6d.	101	5s. 3d. to 6s. 3d.	105	7s. to 9s.	98	8s. 6d. to 9s. 6d.
Second bedroom	124		101		105		126	
Total -	377		357		386		378	

AVERAGE RENTS.—It may be stated that if the rents exceed 2s. 6d. a room for an associated tenement and 3s. 6d. a room for a self-contained tenement, the scheme is likely to be a failure from the point of view of housing the poorer portion of the working-classes. The average rent per room charged by the Guinness Trustees is 2s. 1½d., and included in this low rent is the free use of baths, club-room, Venetian blinds, chimney sweeping, and boiling water obtained from a specially constructed urn-house. For a nominal charge a tenant can have the whole of his washing dried in a special heating chamber or drying-room. To insure

that none but the poorest wage earners benefit by the Guinness Trust, no tenant is accepted who earns more than 25s. per week.

Of course, in certain districts where the value of land is abnormally high, such as in the City of Westminster, it is impossible to let rooms at less than 3s. to 3s. 6d. each, even on the associated principle, but it must be borne in mind that the occupants of the new buildings—chiefly artisans in a position to pay such rent—would have vacated other premises which would soon become let to their less fortunate brethren.

I will now give you some of the most important considerations in deciding upon the suitability, both from a financial and sanitary point of view, of any site or area for housing purposes, and which will enable you to form a judgment of the merits of any plans for covering the land which may be laid before you.

Cost of Sites.—The cost of land in urban districts should not exceed £20 for each room which can be placed thereon, and this amount is subject to my remarks hereafter under the heading of Subsoil.

In suburban districts where cottages are intended, the cost of land should not exceed £1,800 per acre. No site for block dwellings should be less than half an acre, and if possible 1½ to 2 acres, the cost of maintenance and superintendence not increasing in ratio to the extent of the area of the site. A square piece of land is most desirable, without awkward angles which cannot be developed. It enables the architect to design the buildings square, a great factor in saving expense and also in economical planning. The land should have frontages to as many streets as possible to avoid the waste of land involved by forming new roadways on the site.

Subsoil.—The next important element to be considered is the subsoil. The most advantageous site on which to build is one with a good bed of gravel near the surface. This not only saves the cost of excavating to a great depth and putting in deep foundations, but, in addition, the gravel obtained from the excavations can be sold and will pay part of the cost of the foundations.

If there is a bad subsoil, which is often the case, and it becomes necessary to excavate to a great depth before a sound bottom is reached, then a half-basement should be built—*i.e.*, the lowest story should be sunk 4 or 5 feet below the surface of the ground, so that the expense of excavation is not incurred in vain. Before purchasing a site a series of trial holes should be dug, so as to ascertain the exact nature of the subsoil.

Height and Position.—Block dwellings are rarely built less than four or more than six stories. The most usual number of floors is five without or six with a half-basement. The greater the number of stories the more economical is the building, as the cost of the land, foundations, paving, drainage, and roof would be a constant factor, and would be spread over a larger number of rooms in a five-story building than in a four-story building.

Cottages are never built more than three floors high—lower ground, ground, and first floors—the cost of land being comparatively small where such dwellings are erected.

The buildings, wherever practicable, should face east and west, so that every habitable room may obtain a share of sunlight every day.

Construction.—The buildings should be substantially constructed to avoid constant renewals and repairs. All pipes, except supply pipes, should be exposed, though not unduly, and easily accessible, and soil and waste pipes should be provided with sweeping holes. Staircases, corridors, and w.c.'s should have high tile dados to save frequent cleaning. Internal gutters should be avoided, as they get stopped up by snow and dirt, and strong eaves gutters substituted. Access to the roof therefrom can be easily and safely gained to execute any needful repairs without the expense of scaffolding.

All architectural effect should be obtained by a picturesque skyline, and by means of great variety in the treatment of the windows. Projections should be avoided, owing to the extra cost involved, except where the plan necessitates them.

Block dwellings should be fireproof throughout, and the floors

of all laundries, w.c.'s, landings and corridors covered with some hard imperishable material.

Ample provision should be made in the design for sufficient space between long blocks of dwellings to give light and air and to form playgrounds, but it is very important that there should be due and proper relation of such spaces to the overlooking rooms, so as not (as is sometimes the case) to sacrifice the dimensions of the rooms to the size of the outside spaces and *vice versa.*

MANAGEMENT.—Great care must be exercised in the management of all housing schemes, both during and after completion, so as to insure economical working. A great saving in the initial cost of construction may be effected by entering into separate contracts with each specialist employed in the erection of the buildings, instead of entering into one contract with a builder for the whole job, including work which he never executes, but upon which he expects a profit. The following may be considered specialists' work: (*a*) Foundations; (*b*) sanitary goods; (*c*) iron ranges, mantel registers, coppers, railings; (*d*) fire-proof floors; (*e*) paving; (*f*) artificial stone and plastering.

When the buildings are completed, an efficient superintendent and one or more porters (handy men), according to the size of the undertaking, should be appointed. The superintendent's duty should be to generally supervise the dwellings, to collect the rent, and pay the money into a local bank, and to control the work of the porters. The porters' duties should consist of keeping the buildings in order and whitewashing and colouring the tenements before reletting to a new tenant, and doing any small repairs found necessary.

If these measures be adopted the outgoings will be considerably less than if a staff of clerks is employed at a central office to collect the rents, keep the accounts of money received from each tenant, and to issue instructions to a builder on every occasion that some trifling repairs are needed.

The internal and external painting and any important repairs should be done periodically at fixed intervals, and a certain sum ought to be set aside annually to meet this expenditure.

The only items amongst the outgoings which it is impossible to control or reduce are rates and taxes, which, unfortunately, have risen so much in most districts of late years as to materially affect rents, but it is not unusual for the landlords to pay the taxes at a compounding allowance of 10 to 15 per cent.

SINKING FUND.—The last item remaining to be considered in all housing schemes is the sinking fund. The annual amount required to be set aside to repay the cost of land buildings varies according to the number of years over which the repayment is spread. The Treasury have decreed that public bodies raising money for housing purposes shall repay the loan in sixty years. There is, however, every prospect that this period will shortly be extended to eighty years, which will make a very material difference to the amount to be reserved annually as sinking fund, and in some cases reducing the weekly rent as much as 3d. per room.

PRIVATE ENTERPRISE.—Private bodies erecting dwellings need not hesitate to extend the period to 100 years, as the buildings, if properly constructed, will not only last considerably longer than that time, but will be a valuable asset for many years after the loan has been repaid. It also appears to be unnecessary to provide more than a very moderate sinking fund on the land, which cannot, of course, disappear, nor decrease in value to any marked amount. It is much more likely to increase than decrease in value in any of the thickly populated districts where housing schemes are required.

RESERVE FUND.—A small sum should be set aside annually and allowed to accumulate, to meet any large items of unforeseen expenditure which might possibly occur, such as sanitary improvements, replacing worn-out or defective ranges or coppers throughout the buildings.

PARTIAL RESULTS. — It has been clearly demonstrated by experience in London and elsewhere that it is possible to house the working-classes at low rents and yet obtain a fair and remunerative rate of interest on the capital employed. It should, however, be borne in mind that, notwithstanding the efforts hitherto of private individuals, public companies, philanthropic

trusts, and public authorities, practically no great headway has been made in dealing with this pressing problem, for all the schemes completed or in hand have not been sufficient to keep pace with the natural growth of the working-class population of our great towns. It, therefore, seems an almost overwhelming and hopeless task, even with public and private enterprise combined, to provide decent homes for the whole of the huge army of workers, whose members are constantly increasing, unless there be further legislation, making it, amongst other things, compulsory, when a site of certain size is cleared for any purpose whatever, for the owner to rehouse all persons of the working-class displaced by such clearance.

Since this paper was outlined the Joint Select Committee appointed to consider the present standing orders has recommended that in London every case in which workmen's houses are taken should be notified to the central authority, whilst outside London the attention of the central authority should be called to all cases where thirty persons of the labouring class are displaced. The fixing of rents for new workmen's dwellings in London by the central authority is also recommended.

Road to Success.—As a nation we are slow to recognise the urgency or necessary extent of reform, but, without being led away by the sentimental excesses of enthusiasts possessing more warmth of heart than coolness of judgment, I see no reason why this large question should not be solved by persistent energy and earnestness, by the application of common-sense, and by putting it—as we do, or endeavour to do, our own affairs, and as we do, or endeavour to do, the affairs of the Empire—upon a proper business footing.

Beyond that, if it be necessary to kindle our enthusiasm toward poor humanity, to warm our hearts toward those in need of our help and practical sympathy, let us remember to

> "Be sorry for the unlicensed class, the poor,
> Reduced to think the best good-fortune means
> That others simply should be kind to them."

RURAL HOUSING AND THE PUBLIC HEALTH.

BY

MISS CONSTANCE COCHRANE.

THE question of Rural Housing is one which closely affects the health as well as the comfort and convenience of the agricultural labourer; and his wife and children especially suffer from the present miserable condition of their surroundings, for the man is seldom at home excepting to eat and sleep.

It is the woman who breathes all day the polluted air from the filthy cess-pit, the uncovered and decaying "ash" heap, the ill-constructed and evil-smelling drain or ditch; and even in her living-room there is often the sickly odour which emanates from such food as bloaters, cheese, meat, etc., shut up in a small dark cupboard, which can only be ventilated into the room. It is the woman who cannot scrub or dust her bedrooms because everything falls through the cracked or rotten floor on to the furniture in the room below. It is the woman who cannot stand upright when she makes her beds, who is always papering over the damp and falling plaster, and constantly whitewashing the ceiling because the chimney smokes, often so badly that she would be choked if the outer door were not kept open.

And then as to the water-supply. Probably the most dangerous to health is the shallow, dry-steened well, close to the back-door, cess-pit, pig-stye, etc., which, on account of its convenient situation, has many more friends amongst the poor than it deserves. But very often the only supplies are the village ponds or one or two badly-constructed, dry-steened, seldom-cleaned-out pump-wells, at a distance of perhaps 600 yards or more from parts of the village. The ponds from which the people sometimes drink at other seasons smell offensively, are badly discoloured, and not fit even for washing purposes.

And here, again, it is the mother and children who are the greatest sufferers, for the woman does the washing and cooking, and it is she and her children who have to drink the water

or if it be too bad they drink tea, a supply of which is kept cold for the children, and is usually made by pouring boiling water on to the tea-leaves left from the last meal.

The amount of valuable rain-water that is wasted in rural districts is deplorable, and in localities where water-supplies are scarce it is greatly to be desired that the proper storage and distribution of rain-water should be made compulsory, and that the nuisance occasioned by the spouting of a cottage being broken, which causes the rain to soak into the walls and foundations, should be promptly remedied.

During the last few summers the distress occasioned by the want of water, or by the scanty supply from a foul and polluted source, has been very severely felt in country villages.

In such districts, also, especially on flat land, the provision of earth closets should be enforced, and where the people have no gardens the Sanitary Authority should be compelled to make arrangements for the periodical removal of the contents of such. It is probable that in most villages some local farmer would be found willing to do this for a small remuneration for the sake of the valuable soil.

As a sample of existing housing and sanitary conditions, there are at the present moment in a village in Cambridgeshire two cottages facing the high-road, and occupied by thirteen persons, using the same dilapidated sanitary convenience, which, as the cottages have no back-doors, can only be approached by the occupants of the first cottage passing immediately in front of the windows and door of the second. This cottage, which has only one bedroom, is occupied by a man in an advanced stage of hip disease, his wife, and five children. For some time the bedroom was considerably overcrowded, according to the recognised standard of 300 cubic feet of space for persons over ten years of age, and 150 for those under ten. The fact was for some time denied by the Sanitary Authorities, but, after strong representations from outside, one of the elder children was ordered to sleep downstairs. Three of the children have been born since the man has been in receipt of outdoor relief from the Guardians, and the two youngest are badly crippled and diseased. The mother is a

very dirty, untidy woman. The family are now receiving 7s. a week parish out-relief.*

Happily, such conditions are not universal, but that they do exist, and to a very large extent, there is abundance of evidence to prove; and numerous reports, giving full details of dilapidation, neglect, and insanitation, have been, and continue to be, supplied by medical men, inspectors, clergymen, and others, and from the people themselves, from all parts of the country. A constant reason given for not condemning cottages obviously unfit for human habitation is that there are no others for the people to go into.

The above remarks will give rise to several lines of thought. One only will be touched upon for a few moments in this paper—viz., that which appeals to those who realize how closely the whole question affects the public health, and therefore the prosperity and stamina of the nation. If it be true that there are 473,000 fewer agricultural labourers than there were fifty years ago, it is time that the nation should decide whether it is content to have it so.

According to the statements of many aged persons, it appears to be an undoubted fact that in the villages with which the writer is best acquainted—in Huntingdonshire, Cambridgeshire, and surrounding districts—the health of the young women and girls has very much deteriorated in the last fifty years. Indigestion, anæmia, constipation, and general low health are universal. Girls are at home for months together unfit for service, either under medical advice, or dosing themselves with quantities of quack medicines. And, most serious of all, these girls are to be the mothers of the future generation. A prominent medical man in Peterborough stated recently that nearly all his anæmic patients came from the villages. Enteric and diphtheria are constantly prevalent in the rural districts, and in some of them are endemic. Proofs of this are afforded by the special reports made to the Local Government Board during the last few years by their various medical inspectors. A perusal of these reports will reveal deplor-

* The writer of this article will be pleased to furnish any reader with copies of a correspondence which has taken place in connection with this case between the Guardians and Rural District Council.

able conditions of sanitary administration, bad housing, water-supply, etc., and the public have not even the satisfaction of knowing that the very necessary recommendations made by the able and experienced officers of the State have been, or are in many instances likely to be, adopted, owing to the indifference of the District Councils.

A large number of Rural District Councils have failed to realize their responsibilities, and have proved themselves utterly unfit for the work of sanitary administration. When it is remembered that most of the members of the Council are either owners of insanitary property, or tenants or near neighbours of those who are, this can hardly be wondered at. Also, the work, if properly done, is laborious; and the great majority of the Council being busy farmers, and many of them far from wealthy, who, as well as the bulk of the people they represent, are completely ignorant of the laws of health, and have neither the time, means, nor inclination to study them.

In view of these sad and true facts, in addition to others which concern the cities and towns, it is considered by many that the time has arrived when the public health should receive from the State a much larger share of practical attention than has been accorded to it in the past. Amongst the reforms most urgently needed are: the codification of the Public Health Acts in such a form as to be "understanded of the people," the compulsory appointment of County Medical Officers of Health, more inspection by properly qualified inspectors, local medical officers to be differently appointed, and the transfer of land at a fair price to be made cheap and easy.

If the free advice and superintendence of experts, from a central or county organization, on schemes of water-supply, drainage, building, etc., were available, it would not be necessary to lay too heavy a burden on the poorer rural districts.

As the duties of the Local Government Board are already numerous and onerous, it is sincerely to be desired that the movement in favour of a Minister of Public Health (who should be an eminent and practical man) will receive the fullest consideration, and that, without delay, some attention will be directed to the long-standing sanitary requirements of the rural districts.

SOME POINTS IN THE MANAGEMENT OF DIPHTHERIA AND SCARLET FEVER.

BY

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THERE are probably few questions concerning which a greater variety of professional opinion exists than those relating to certain points in connection with the management of acute infective diseases. The divergence of practice which results as a necessary consequence of the above fact covers, as is well known, a field of no small dimensions, ranging from that of the "practical man," who considers a case of diphtheria safe after the lapse of a reasonable interval since the disappearance of clinical signs, to that of the scientific physician, who bases his opinion, under like circumstances, on the presence or absence in the throats of his patients of those micro-organisms believed to be causally associated with the disease in question. In a most interesting and suggestive paper by Dr. A. Griffith, M.O.H. for Hove, which appeared in the recent October number of *Public Health*, the following statement occurs: "For my own part, I act on the principle of keeping patients under control in hospital until all diphtheria bacilli are gone—*i.e.*, until a throat-swab when incubated does not produce any." Later on we read as follows: "I have a few times had relapses in convalescent patients, when others with fresh illness have been admitted to the same wards."

Relapses amongst patients who are convalescent from the disease, but who have been kept in diphtheria wards, appear to be common enough, and seem to furnish a fairly strong argument against making the absence of bacilli from the throat the true criterion of safety. If the bacilli left in the throat after an attack of diphtheria are possessed of virulent properties, it seems somewhat unaccountable that their host should be able to exhibit the external manifestations of health and also be liable to a recurrence of the illness recovered from if exposed to the attack of organisms possessing the same pathogenic powers as those

which he already harbours. Is it possible, in other wards, for a convalescent patient to be immune to virulent bacilli remaining in his own throat and at the same time be open to the inroads of germs of a similar nature, but derived from a different source? The fact that a patient convalescent from diphtheria, with virulent bacilli still in his throat, remains free from all gross appearance of the disease, although liable to its recurrence, contains a contradiction of which the explanation is not yet forthcoming, and at the same time raises the question as to how far such bacilli are capable of propagating the illness of which they are held to be the cause, or, to put the matter shortly, are these bacilli virulent or are they not?

It is, of course, possible that attenuation may have taken place during the acute attack, but that the original powers of the organisms are readily regained in the body of a new host, and such a fact would be quite in accordance with what we know regarding the influence of external conditions on all forms of life.

That virulence is actually regained in the manner named above must, however, be the exception rather than the rule, and notably so in view of the well-known fact that diphtheria bacilli appear to spread themselves broadcast throughout populous communities, without, however, causing any corresponding prevalence of disease.

To quote, in this connection, from Parkes and Kenwood's "Hygiene and Public Health": "In large towns where diphtheria is endemic, it would appear from recent statistics that 5 to 10 per cent. of the children of the working-classes have the bacillus in their throats, and in the majority of these cases there is no evidence of any unhealthy condition of the fauces." Personally, after a fairly prolonged experience in both military and civil life, I have acted on the assumption that we have no certain means of telling whether the bacilli in the throats of convalescents from diphtheria are virulent or the reverse, but that it is absolutely unjustifiable to retain such patients in contact with acute cases until the throats of the former are free from an organism whose capabilities for mischief I am by no means sure of. The

period of exclusion advised by the Association of Medical Officers of Schools, as set forth in Whitelegge's "Hygiene and Public Health," 1899, appears to be amply sufficient to meet all ordinary cases—viz., three weeks after an attack, if convalescence be complete and there is no sore throat, albuminuria, or discharges. All discharges, of course, need most careful attention, and I believe that a most excellent safeguard against the spread of infection consists in the frequent application of germicidal solutions to the nasal and oral cavities during the whole period of convalescence.

No convalescent should, if possible, remain in the neighbourhood of acute cases. The occurrence of the relapses referred to is sufficient indication for the necessity of this measure. The establishment of convalescent wards should be regarded in the light of a necessity in all isolation hospitals.

Although the virulence of bacilli in the throats of convalescents appears to be by no means certain, it is quite in accordance with existing knowledge to assume that recently lost virulence could readily be regained under the influence of certain local conditions, notably overcrowding or defective ventilation. For this reason the importance of air-space is at once apparent. The fewer patients there are in a convalescent ward, and the more time they spend in the open air, the better. The establishment of suitable grounds for exercise in connection with fever hospitals constitutes, without doubt, a most important measure of both curative and prophylactic medicine. After recourse to such steps as those indicated above, I cannot recall a single case which caused the spread of infection after discharge from hospital, and this in spite of the fact that the absence of bacilli from the throats was not assured. It is, of course, admitted that under such conditions the period at which the bacilli definitely lose their virulence is only arrived at empirically.

It should be particularly noticed, in the light of recent researches, that the urine in cases of diphtheria has not altogether attracted that degree of interest which its powers as regards infectiveness appear to merit. After experimental inoculation of an animal with a diphtheritic culture, virulent diphtheria bacilli

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have been found in the urine, and Roux and Yersin have caused paralysis and death in animals by subcutaneously injecting urine from diphtheritic cases. It is also well known that the characteristic bacilli are found in the kidneys post-mortem. The practical lesson to be drawn from these facts is not far to seek, and it seems fairly certain, in view of the above, that the urine of diphtheritic cases should be submitted to the action of one or other of those chemical germicides of which our professional armamentarium contains no lack.

As regards the question of diagnosis, there is no doubt that the microscope and test-tube do not, at all times, yield infallible evidence as to the nature of the lesion to be dealt with, and resort to these methods of inquiry may result in the loss of valuable time. Two cases which occurred within my experience bring these facts forcibly to mind. The first case was that of a young lad, whose condition formed the subject of a consultation between two practitioners in the same town, who decided to submit a swab of the patient's throat to bacteriological investigation, before sending the boy to the local fever hospital. Before any conclusion was arrived at the patient unfortunately died of diphtheria. I have no information as to the result of the microscopic and cultural tests.

The second case was that of a man of about twenty-five years of age, seen for the first time in a state of extreme dyspnœa, with what presented all the appearance of a well-marked diphtheritic membrane almost occluding the interval between the fauces.

A swab was sent to a well-known London laboratory for examination and report, but in the meantime the case was provisionally diagnosed as diphtheria, and a full dose of antitoxin was administered. Next day the membrane had all but disappeared, and by the time that the patient was on the high road to convalescence, the report from the laboratory announced the swab to be free from diphtheria bacilli. Such cases, I am led to believe, are by no means singular.

Briefly, personal experience seems to dictate:

1. That convalescents from diphtheria should not be left in

contact with acute cases, as recurrence under such circumstances is likely to occur.

2. That a decision as to the safety of any patient as regards the spread of infection should be arrived at by the absence of all clinical signs, plus a reasonable margin time during which treatment, as indicated above, should be continued.

3. That bacteriological tests should be regarded in the light of corroborative evidence only, and in no circumstances should they constitute a reason for delay in active treatment, when the latter seems called for in the light of clinical signs.

It also seems likely, as already stated, that there exist other channels of infection than those which, up to the present, have largely monopolized attention.

As regards scarlet fever, the same measure as in diphtheria holds good—viz., the separation of acute and convalescent cases, and, as stated below, for two distinct reasons.

Firstly, there is no doubt that patients recovering from the disease who are herded in the same wards with those recently attacked, are liable to suffer an unmistakable relapse in which the throat symptoms, it may be noted, tend to assume an exceptional severity. In the Aldershot Isolation Hospital patients who are convalescent are removed from the acute wards at the earliest opportunity, and the results of this measure have amply justified its adoption.

Secondly, the importance of Dr. Niven's observation, as regards the connection between "return cases" and the association in immediate proximity to each other of patients in the acute and convalescent stages of the illness, can scarcely be overestimated, and would in itself constitute a sufficient reason for the separation of the cases in question.

At Aldershot "return cases" have, I believe, been unknown up to the present. There is apparently no doubt that such are frequently the result of articles of clothing, etc., belonging to the patient being left in the house when he was removed to hospital and reproduced on his return to his family. The military procedure does away with any such possibility. All articles of kit and bedding belonging to the man are brought to hospital

with him, and are there disinfected by steam, except, of course, in the case of those substances to which such a measure is inapplicable, and which are subjected, as a rule, to the influence of izal, or other germicide. Izal I believe to be particularly useful.

There is good reason to believe that the occurrence of "return cases" can, at any rate to some extent, be obviated by disinfecting as far as possible the skin, and the nasal, auditory, and aural cavities, for several days before the patient's discharge from hospital, and personal experience leads me to place considerable faith in these measures.

Troublesome sequelæ appear often to be the result of discharging patients from hospital, particularly children, after a hot bath, on a cold or inclement day. If a discharge has of necessity to be carried out under these circumstances, too great care cannot be exercised in seeing that the patient is warmly and suitably clad.

I am quite aware that some of the above statements are not likely to meet with general acceptance, they are, however, only intended as expressions of opinion founded on experience, and not as assertions of fact.

The experience of others may of course be widely different, but every particle of evidence, no matter how slight, should be of some value in regard to matters of the highest importance, but concerning which our knowledge is not yet accurate.

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Walter Lowe, Esq.
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RETURN CASES OF SCARLET FEVER.

We have received an interesting and full report of a case recently tried in the Lowestoft County Court, in which a claim was made against the Corporation for damages estimated at £50, which the plaintiff represented himself as having sustained by reason of the negligence of the defendants or their servants in discharging his daughter from the Lowestoft Isolation Hospital in a verminous, and therefore infectious, condition, with the result that two other of the plaintiff's children became infected. The child had been in the hospital over nine weeks. Apart from the questions of law, which the judge unhesitatingly decided in favour of the defendants, two questions of scientific interest appear to have been involved in this case. As regards the first, whether or not it is possible for infection to be carried by lice, the evidence called was conclusive that, as far as is at present known, lice are not instrumental in communicating scarlet fever. But the matter is one which deserves full investigation, because the suggestion that infection may be thus conveyed from one person to another is by no means impossible when we recollect that pathogenic organisms of other diseases are undoubtedly disseminated by insects.

The second question, which relates to the period of detention in an isolation hospital and the subject of return cases of scarlet fever and incidentally of diphtheria, is one which is of vital interest to the ratepayers throughout the country. In a paper entitled "Infectious Diseases: Length of Stay of Patients in Hospitals and Return Cases," Dr. Bond, Medical Officer of Health of the Metropolitan Borough of Holborn, surveys this question from the point of view of the medical man who has had personal experience of the system of the Metropolitan Asylums Board Isolation Hospitals, and who, in the interests of the ratepayer, is concerned with the reduction of the expenses of maintaining isolation hospitals.

In order to ascertain whether or not the present period of detention in isolation hospitals—which varies from nine weeks in the hospitals of the Metropolitan Asylums Board to four weeks at Leicester—cannot be greatly reduced, Dr. Bond first considered

the nature of the infectivity of scarlet fever, with the result that he concludes: (1) that there is now very strong and increasing evidence that at least the later desquamation of scarlet fever is not infectious; (2) that bacteriological researches indicate that the principal source of infection in the later as in the early stages of both scarlet fever and diphtheria is the tonsillar and buccal mucus; and (3) that throat and mouth disinfection with solutions of potassium permanganate, or liquor chlori, or other efficient disinfectants, should be practised in all cases in addition to other clinical treatment, with a view to controlling, reducing, and ultimately exterminating the micro-organisms which have formed their nidus in the tonsillar or buccal mucus.

These conclusions enable Dr. Bond to infer that the period of detention in isolation hospitals of scarlet fever and diphtheria may be greatly diminished with advantage—*bien entendu*—to the ratepayer. Dr. Bond further advises: (1) systematic bacteriological examination with a view to the discovery of complications, such as the coexistence of diphtheria with scarlet fever, and *vice versâ*, and the minimizing of the number of cases of post-scarlatinal diphtheria or post-diphtheritic scarlet fever; (2) the issue of printed instructions of warning to the parents or guardians at or before the time of discharge of a fever patient; (3) the notification to the Medical Officer of Health of the district or town of the discharge of a fever patient, mentioning at the same time any details of nasal, aural, or other complications.

The main difficulty in putting these suggestions into force consists in the fact that the parents or guardians may not be able—or, if able, willing—to continue the disinfectant treatment for the necessary length of time. It must be remembered, when animadverting on the period of detention in the isolation hospitals of the Metropolitan Asylums Board, that the responsibility whether a case should be admitted, and, if admitted, when it should be discharged, is left entirely with the Medical Superintendents. The law governing this question is that no case should be admitted that is not infectious, and that no case should be discharged that is infectious. In their anxiety to avoid return cases, the Medical Superintendents have adopted a policy of extreme caution, which,

as a fact, seems to have had results far different from those anticipated, for the number of return cases has shown no sign of serious diminution. The great difficulty in the way of reducing the period of detention is that medical practitioners have not arrived at the unanimous conclusion with Dr. Bond that the later desquamation of scarlet fever is *not* infectious. If the Superintendents were to discharge patients before "peeling" is finally complete, they are very well aware that they would have to face a storm of indignation from angry parents, supported only too often by their medical advisers, who cling to their belief in the infectivity of scarlet fever at all stages of desquamation.

Furthermore, a large number of cases are sent to the infectious hospital owing to a wrong diagnosis, which are apparently detained in hospital for an average period of three weeks.

The whole subject is receiving careful consideration from a special Committee of the Metropolitan Asylums Board, with the present result that Medical Superintendents of the Board's isolation hospitals have been directed, when discharging a case, to notify the fact of the discharge to the Medical Officer of Health of the district the patient resides in as well as to the parent or guardian.

INTERNATIONAL CONGRESS OF HYGIENE AT BRUSSELS.

The 11th International Congress of Hygiene and Demography will be held at Brussels from the 2nd to the 8th September, 1903, under the patronage of H.M. the King of the Belgians, with H.R.H. Prince Albert of Belgium as Honorary President.

The General Secretary to the Congress is Professor F. Putzeys, 1, Rue Forgeur, Liége. The Congress will be held in two divisions: I., Hygiene; II., Demography. Division I. comprises the following sections:

A. Bacteriology, Microbiology, Parasitology.
B. Hygiene of Food Products, including Chemical and Veterinary Science.
C. Sanitary Technology.
D. Industrial and Professional Hygiene.
E. Hygiene of Transports, Trains, Troopships, Emigrant Ships.
F. Administrative Hygiene, Prophylaxis of Infectious Diseases, and Infantile Hygiene.
G. Colonial and Tropical Hygiene.

THE CREMATION ACT.

THE Cremation Act, 1902, became law on July 22, 1902, and comes into effect (Section 15) on April 1, 1903. By this Act (Sections 2 and 4) a burial authority which is maintaining a cemetery under the Public Health (Interments) Act, 1879, or under any local Act, is permitted to provide crematoria, but the plans and site of any proposed crematorium require the approval of the Local Government Board, and the crematorium must be certified by the burial authority to the Secretary of State to be complete, built in accordance with such plans, and properly equipped for the purpose of disposing of human remains by burning. Section 5 orders that "no crematorium shall be constructed nearer to any dwelling-house than 200 yards, except with the consent in writing of the owner, lessee, and occupier of such house, nor within 50 yards of any public highway, nor in the consecrated part of the burial-ground of any burial authority." Section 6 permits a burial authority to accept donations of land or money for the purpose of building or maintaining a crematorium. Section 7 orders that "the Secretary of State shall make regulations as to the maintenance and inspection of crematoria, and prescribing in what cases and under what conditions the burning of any human remains may take place, and directing the disposition or interment of the ashes, and prescribing the forms of the notices, certificates and declarations to be given or made before any such burning is permitted to take place." The section also enacts that the regulations be presented to Parliament, and, unless an address be presented to the King by either House praying His Majesty to withhold his assent within forty days, such regulations are to have the same effect as if they were enacted in the Act.

Section 8 enacts the penalties for a breach of the regulations, for a false declaration, and for attempts to procure cremation with intent to conceal the commission or impede the prosecution of any offence.

Section 9 relates to fees, which require the approval of the Local Government Board.

Section 10 saves the jurisdiction of coroners.

Section 11 releases an incumbent of any ecclesiastical parish from the duty of performing a funeral service in cases of cremation, and authorizes any clerk in Holy Orders of the Established Church, not being prohibited under ecclesiastical censure, to do so, with the permission of the Bishop and at the request of the executor or burial authority. The remaining sections are of technical importance only.

On October 12, 1902, a Departmental Committee was appointed by the Home Secretary to prepare draft regulations under Section 7, which deal with the four points:

1. The maintenance and inspection of crematoria.
2. The cases in which, and conditions under which, cremations may take place.
3. The disposition of the ashes after cremation.
4. The registration of cremations.

The report, which has now been issued, deals firstly with the danger of cremation being used to destroy evidence of crime. The Committee feel that regulations can be framed which will so reduce this risk as to make cremation at least as safe as the existing method of burial. The truth is that real, valuable reform can only be effected by securing the critical examination of medical certificates before they are accepted and duly recorded in the death register. The registrars, who have no medical qualifications, are clearly unable to discharge this duty. Further, it must be remembered that "burial may take place either without any certificate of the cause of death, or on the certificate of one medical man, which may be in the vaguest and most uncertain terms."

The Committee concluded that "in every case there should be required either (*a*) two certificates, one given by the medical attendant, the other by an independent person—the medical referee, or a doctor nominated by the cremation authority, or a person holding one of the following appointments: Medical Officer of Health, Police-Surgeon, certifying Factory Surgeon, or Medical Referee under the Workmen's Compensation Act, or hold

an appointment as physician or surgeon in a public general hospital containing not less than fifty beds; or (*b*) a certificate given after a post-mortem by a pathologist named by the cremation authority, who may or may not be the medical referee; or (*c*) a certificate by a coroner given after an inquest.

"If the certificates under heading (*a*) do not show the cause of death definitely, and in such terms as to preclude the possibility of poison or violence as the cause of the death, the cremation should not be allowed unless a post-mortem has been held and a certificate given as under (*b*). If this does not sufficiently reveal the cause of death, and if the relatives still desire cremation, there must be an inquest."

Regulation 14, however, permits the suspension by the medical referee of these regulations in the case of any person dying of plague, cholera, or yellow fever on board ship, or in a hospital or temporary place of reception, and further provides for the temporary suspension or modification of these regulations in any district during an epidemic by an order of the Secretary of State on the application of a local authority.

From a very thorough examination of the circumstances of ninety-five cases of exhumation which took place during the nine years 1893-1901, either by the orders of a coroner or of the Secretary of State, the Committee were of opinion "that in the four cases where exhumation led to conviction and sentence for serious crime, the cremation of the body would have been impossible under the Draft Regulations, and that an application for cremation might possibly have resulted in the earlier detection of the crime."

The regulations relating to the maintenance and inspection of crematoria, to the disposition of ashes, and to the registration of cremations, are commendably brief and simple. The spread of the practice of cremation may reveal weak spots, which can be made more secure by more rigid rules. Cremation will now have a chance, and in these regulations, which might at first sight seem to hamper its progress, are to be found advantages, among which we may properly count the great effectiveness of the system thus introduced in guarding the innocent from unfounded suspicions.

BACTERIOLOGICAL NOTES.

I.

SHELL-FISH AND TYPHOID FEVER.

BY

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ONCE again public attention has been directed to the dangers lurking in edible shell-fish, and the recent outbreaks of typhoid fever at Southampton and at Winchester due to the consumption of sewage-contaminated oysters, regrettable as they are, will have done good if, through them, legislative action is taken to safeguard the shell-fish layings, etc., from sewage pollution.

In 1895 the late Sir Richard Thorne presented to the Local Government Board a report by Dr. Bulstrode on the cultivation of oysters and certain other molluscs in relation to the occurrence of disease in man. This report had reference to oysters, mussels, cockles, and periwinkles, and it was disquieting, to say the least, to find that so few of the sites of the shell-fish fisheries, layings, storage-ponds, etc., could be considered to be free from at least the risk of sewage pollution. As the outcome of this report, in 1899 the Local Government Board introduced a Bill providing that the various County and Borough Councils should ascertain from time to time the sanitary condition of oyster layings, and empowering these bodies to prohibit the taking of oysters for sale for human food from sewage-contaminated layings except after deposit for ten days in a place free from such pollution. This Bill, which dealt only with oysters, after being read for a second time was withdrawn, and apparently nothing has since been done.

But the danger of the transmission of typhoid fever through contaminated shell-fish has constantly been brought to notice by the occurrence of sporadic cases or of small outbreaks.

In 1901 the Medical Officer of Health for Westminster reported on certain cases of typhoid fever apparently due to eating cockles,

and from certain cockles the typhoid bacillus was isolated by Dr. Moore at the Jenner Institute of Preventive Medicine. The method which was successful in the isolation of the typhoid bacillus in this case was the use of plate cultures of the contents of the cockles in the Elsner agar medium devised by Dr. Moore.* During June and July of last year an outbreak of enteric fever occurred at Southend-on-Sea, due to the consumption of cockles from Leigh Creek, and cases due to infection from cockles in Southend appeared to have occurred in London. Thus in a report dated November, 1902, the Medical Officer of Health for Shoreditch stated that in the preceding summer twelve cases of enteric fever occurred in Shoreditch, the patients having been visitors to Southend, and whilst there having eaten cockles.

Dr. Nash, the Medical Officer of Health for Southend, states that "in 1901 I found that in no less than twenty-one out of thirty-seven cases of typhoid fever which occurred between August 15 and December 31 there was a history of eating shell-fish (generally oysters and cockles) within a month of the onset of illness—*i.e.*, within the incubation period." On December 5 last, Dr. Caldwell Smith, Medical Officer of Health for the Borough of Wandsworth, reported to the Medical Officer of Health for the City of London that four cases of typhoid fever had occurred among residents in Clapham, and that in each case there was strong evidence that the disease had been caused by eating cockles purchased in the City. In consequence, samples of cockles were examined by Dr. Klein, and in all sewage contamination existed in a marked degree, and in certain cockles the typhoid bacillus was actually isolated.†

Under the Public Health (London) Act, 1891, it is possible to obtain a justice's order to destroy any article of food which is unfit or unwholesome for the food of man, and infected cockles would certainly come under this category. But the necessary examination involves the lapse of a considerable time, in most cases five or six days, and before the results of such examination could be known in the case of any one sample, the whole

* *Brit. Med. Journ.*, 1902, I., p. 703.

† *Report of Medical Officer of Health City of London* No. 54.

quantity from which such sample was taken would have been consumed. Under these circumstances, therefore, the facts were reported to the Worshipful Company of Fishmongers, which has extensive powers over the fishing industry throughout the country, and the Company has instituted a series of inspections of the sites of the shell-fish fisheries throughout the kingdom.

Of eighteen samples of oysters from five places—viz., Emsworth, Bosham, Mumbles, Southwick, and Whitstable, eleven were found to be polluted as under:

Of one Emsworth sample one was contaminated.
Of two Bosham samples two were contaminated.
Of five Mumbles samples four were contaminated.
Of two Southwick samples two were contaminated.
Of eight Whitstable samples two were contaminated.

More recently the Glamorgan Sea Fisheries Committee decided to conduct an independent inquiry into the alleged contamination of the Mumbles oysters, and Professor Herdman, with whom was associated Dr. Griffith, was deputed to make the necessary examinations. He has reported that the sea-water and the shore are polluted by sewage, and that oysters laid on the perches and plantations are liable to be infected by any organisms in the sewage. Oysters, however, recently brought from the bay were practically free from sewage organisms. The sea-water (*i.e.*, near shore) contained as many as fifty *Bacillus coli* per c.c.

The bacteriological evidence of sewage contamination consists in the detection of the *Bacillus coli communis* and of the *Bacillus enteritidis sporogenes*. If either of these organisms be present, but especially if both are present together in any quantity, sewage contamination is certain.

It might be thought that sea-water would be inimical to the vitality of the typhoid bacillus. It is true this organism does not seem to multiply in sea-water to any extent, but the experiments of Klein and of Boyce show that it retains its vitality for from three to five weeks in sea-water. Oysters infected with the typhoid bacillus retain their infective properties for two or three weeks, and the infected oysters, if placed in pure running sea-water, may not lose their infective properties for some days.

In cockles, however, the typhoid bacillus seems to thrive and multiply, and these molluscs are not rendered free from infection by laying in pure water.

Cockles are cooked before consumption, and it might have been assumed that the cooking would do away with all risk of infection. Thorough cooking would undoubtedly be efficient, but the cooking of cockles seems to be a very perfunctory process, consisting in merely plunging nets filled with the cockles into boiling water for two or three minutes. Boiling for any time is stated to render these molluscs tough and uneatable.

II.

BACTERIOLOGY FOR GENERAL PRACTITIONERS AND MEDICAL OFFICERS OF HEALTH.

BY

C. J. RUSSELL McLEAN, M.D., D.P.H.,

Medical Officer of Health to the Doncaster Rural and Tickhill Urban District Councils.

"BACILLUS DIPHTHERIÆ" (KLEBS-LÖFFLER).—This organism grows readily on gelatine if it is slightly alkaline in reaction and on agar-agar, but its appearance is most characteristic if cultivated on blood-serum. Löffler's special medium is composed of two parts of blood-serum, one of nutrient broth, and 8 per cent. of grape-sugar; but ordinary blood-serum alone, if alkaline, gives very satisfactory results and is to be preferred to gelatine or agar. If no culture medium is available a piece of hard-boiled white of egg (a serum albumin), on which the organism grows freely, may be used.

Three important points in the cultivation of this organism are (1) that it grows readily at, or even below, the body temperature, 37° C. (98° F.); and (2) that it grows very rapidly, tiny specks being visible to the naked eye after twelve to sixteen hours' incubation, and before any other organism has had time to appear; and (3) that it is aerobic and flourishes best in air.

If one has culture tubes at hand they may be inoculated either by means of a small piece of membrane, removed from the throat

by a long pair of forceps or on a looped needle; but if the specimen has to be taken home or sent by post it is best taken by a sterilized swab of cotton-wool or sponge, remembering that the organisms are more plentiful underneath the superficial layers of the membrane rather than on the surface or underneath the necrotic tissue, and that the swab must be freely rubbed over the membrane, or in its absence over the pharynx and fauces, and not simply pressed on the surface, and also that no antiseptic should have been applied to the throat for at least two hours previous to taking the specimen. The most difficult cases from which to get a specimen are those in which the trachæ is affected in young children.

To make a Sterile Cotton-Wool Swab.—Take a piece of stout copper wire about the length of a test-tube, and bend about half an inch at one end firmly over a piece of cotton-wool, twirl the wool with the fingers into a firm lump somewhat smaller in diameter than the test-tube, fix the free end of the wire into a soft cork or into another plug of wool, which closely fits the mouth of the tube, and, holding the tube *within* the points of a pair of Cornet forceps, pass it the full length backward and forward in a Bunsen-flame for a few minutes. When the wool swab in the tube begins to show signs of scorching it is sterilized. The same result may, of course, be obtained by placing in a hot-air sterilizer. Affix a label, which is filled in when used with the name of patient, date, and clinical information.

Sponge swabs are sometimes preferred on account of their being easier carried or transmitted, and also because they are easily prepared, as they only require immersing in boiling water for a few minutes to sterilize, after which they are squeezed out in a clean towel and enclosed in a piece of sterile non-porous paper. Before using they should be again dipped in boiling water, squeezed out, and applied by forceps to the throat, and immediately replaced in the wrapper and enclosed in an envelope which gives the date, name of patient, etc. All specimens of infective matter should be sent by parcel post securely fastened, and not by letter post, which is contrary to postal regulations. Having obtained a swab, the serum should be inoculated as soon as

possible, this being done in the same method and with all the precautions already mentioned, except, that instead of making two or three strokes on the medium, as when a needle is used, the swab is lightly but thoroughly smeared over the surface of the medium, but without breaking it, taking care to turn the swab round so that every part of it shall be brought in contact with the medium, as it frequently happens that only one side of the swab contains infective material. Avoid touching the clear part of the tube as far as possible.

Label and incubate at 37° C. (98° F.). Before destroying the swab or membrane it is as well to smear a cover-slip with it, and dry, fix, stain, mount, and examine. One can frequently give a *positive* diagnosis by this method, but the absence of any bacilli must not be taken as a certain *negative*, as it just as often happens that, though the organisms cannot be found by this direct method, that they are found later on in the culture. This is especially so in the very early and late convalescent stages of the disease, when fewer organisms are present in the throat than in the intermediate period.

The culture-tube should be examined in about fourteen to sixteen hours, when, if the Klebs-Löffler bacillus is present, colonies will be found appearing in the form of tiny round grayish-white spots, separate from each other. There is little probability of any other organism being visible at so early a period. Later on the colonies will be found to coalesce (though characteristic isolated colonies will still persist at the margin), forming a diffuse opaque patch of a pale salmon-cream colour; but too much reliance must not be placed on the naked-eye appearance of the growths, any more than on the microscopic appearance of a preparation *direct from the throat.* A single *positive* result is of much more value than several of a *negative* character. In the former case there can scarcely be an error, whilst in the latter there is room for many.

A specimen of the culture should now be stained. Fix a clean cover-slip in the Cornet forceps, and on one edge of it place with the needle a tiny droplet of clean water. Flame the needle, and with it remove a very small part of the growth from the surface

of the medium. To do this it is best to simply touch two or three of the colonies with the needle-point (thereby being certain of getting a good average specimen). Do not try to dig underneath and remove the whole little colony, which sticks closely to the serum, or some of the medium will be removed as well, and this is to be avoided. Beginners usually err by taking too much. Flame the mouth of and plug the tube and place it in the rack (an ordinary test-tube rack is useful for this purpose), and subsequently in the incubator for further observation, and then, holding the forceps with the slip in the left hand, insert the point of the needle with the infective matter into the drop of water on the slip, and mix the two gently until a slight emulsion appearance is formed. Spread this evenly and thinly over the cover-slip, flame the needle, let the slip *dry* either in the air or by waving backwards and forwards at some distance above a spirit flame (if held in the fingers there will be no danger of scorching); *fix* the film on the glass, so that it will not be washed off in any subsequent processes, by passing the slip held in the forceps, film side upwards, *three times through the smokeless flame*, and it is ready to stain. This apparently long process takes much less time to perform than to describe.

For staining I prefer Löffler's methylene blue and Neisser's double stain method. The former is simple, rapid, and reliable, the latter characteristic and confirmatory, though other stains such as carbol-fuchsin or carbol-thionin may be used if preferred.

Resting the forceps on the glass slab and being certain that the film side of the cover-slip is upwards (not always so easy a matter to decide as it might appear), drop on to it by the filter funnel as much methylene blue solution as the slip will hold. Allow it to remain for three or four minutes, then wash freely in tap-water (which is usually alkaline), and dry either in the air or by draining into and lightly pressing between two folds of filter-paper (this is better than blotting-paper, which permits of hair sticking on to the slip). I have found when using this stain that slight warming of the solution when on the cover-slip, by holding it over a spirit lamp, improves its staining powers. When quite dry mount the slip in a *small* drop of xylol balsam, taking care that the

film side is now downwards, and the preparation is ready for examination.

Clip the slide on to the stage of the microscope with the iris diaphragm full open, the Abbé condenser screwed up flush with stage, and examine in a good light with the oil immersion lens.

Place a small drop of cedar oil in the centre of the cover-slip by means of the small wooden dropper, and with the *coarse* adjustment lower the lens well down into the oil almost in contact with the glass, but never actually touching it; apply the eye to the eyepiece, and focus by carefully raising the tube with the *fine* adjuster. At first a faint blue haze will be seen, then suddenly, when brought into focus, any organisms present will be observed.

If we are dealing with a case of diphtheria (which is very probable when growths took place after so short a cultivation), the bacilli will appear in the form of long or short, straight or slightly curved rods, having a tendency to slight clubbing at one or both ends (clubs or dumb-bells), and very often a dotted or beaded appearance, due to granular staining.

The chief characteristics of *B. diphtheriæ* are the want of uniformity, both as regards size and shape (polymorphism), and the tendency to polar and granular staining, all of these irregularities increasing with the age of the culture. The organisms may often be observed to lie in parallel groups.

The size of the bacillus varies greatly with the character of the disease, the long variety being usually associated with severe attacks, especially in the early acute stage, though I have found the short forms present in some severe cases. The nature of the medium and the age of the culture have likewise great influence, as, for example, if grown on agar, the organisms are usually long, whilst those grown on gelatine are short. Subculturing, too, often has the effect of changing the shape and size of the bacilli.

The so-called pseudo-bacillus of Hoffman is shorter and thicker than the true Klebs-Löffler organism, shows more regularity, and does not present granular staining. It is frequently found in apparently healthy throats.

After examining a specimen with the immersion lens, the cedar oil should be removed from the cover-slip, either by means of a

piece of filter-paper or a piece of old, soft silk. An effective, though not very cleanly plan, is to scoop it off with the tip of the little finger. The lens should also be wiped in a similar way. If the oil is not removed it forms a hard layer, which interferes with subsequent examinations until the fresh oil has dissolved it. If necessary, the hard film on the cover-glass may be dissolved off with xylol, but it is not wise to apply this to the lens.

It is advisable next to stain a film preparation with Neisser's double stain. To get good results from this method it is necessary that the culture be grown on blood-serum (not agar), that it should be grown at a temperature not over 36° C. (96° F.), and that it must not be over twenty hours nor under nine hours old. It is essential that these points be observed, and also that the stains used be fresh. The stains required are, first, a weak alcoholic solution of methylene blue and acetic acid, and, second, a watery solution of Bismark brown (vesuvin). Any reliable scientific chemist will supply these if so specified. Stain the film with the methylene blue solution for twenty-five to thirty seconds. Wash in water, and, without drying, apply the vesuvin stain, keeping this on the film for fifteen to twenty seconds. Wash, dry, and mount as before. The times given are somewhat longer than those usually recommended, but my experience is that these, or even somewhat longer periods, give better results.

When examined, the bacilli, if present, are found to have a characteristic appearance, the body or sheath of the bacillus presenting a golden brown colour, and containing two or three—rarely more—granules, stained a deep blue or almost black. Very often there is a dot at each end, and one in the middle of the otherwise clear rod. These appearances are characteristic of this bacillus if grown under the conditions mentioned.

This organism is also stained by Gram's method, a useful differential process. For example, *B. typhosus*, *B. coli*, and *gonococcus*, etc., are not stained by the method, whereas *B. diphtheriæ*, *B. anthrax*, *Staphylococcus pyogenes*, etc., are stained. The process is as follows:

Prepare a film as already explained. Stain in *freshly mixed* carbol-gentian violet solution for five minutes. Pour

off and drop on Gram's iodine solution, keeping it on the film for about half a minute, or until the film becomes a dark brown. Wash well in spirit till almost clear; wash well in water and mount.

The gentian violet stains both the ground substance of the film and the bacteria purple. The iodine solution fixes the stain in the bacteria, but not in the ground, so that when washed in spirit the stained organism is left in a clear body ground, and, if so desired, this ground surface can be counter-stained before washing in water by such a stain as Bismark brown. In the case of organisms not stained by this method, such as *B. typhosus*, the iodine has not the fixing property, and consequently the organism is decolourized as well as the ground substance of the film. In such a case we say it is not stained by Gram's method.

The processes above described can be performed with a small amount of apparatus, and, after some practice, with very little trouble; and as the organism often lingers in the throat of a patient for some weeks after convalescence, a ready means is at hand for deciding when such a patient is safe to return to the family circle. And just as it is my opinion that many scarlet fever convalescents are kept too long in acute infective wards in hospital, where they are exposed to the risks of a fresh saturation of bacilli from newly admitted cases, so I believe that many diphtheria cases are not kept isolated long enough, especially in home cases. A culture from the throat and nose should be "negative" before considering a case free from infection.

In many examinations of specimens from the throat we will find other organisms besides *B. diphtheriæ*, the commonest being *Staphylococcus pyogenes aureus* and *Streptococcus pyogenes;* but their coccal and chain forms are easily distinguished from the former. The mixed infection of diphtheria and streptococci is said to lead to a more malignant disease than the pure infection of diphtheria, and undoubtedly it frequently does so, and suggests antistreptococcic serum as well as diphtheria antitoxin in the treatment, though I have seen mild and quickly recovering cases

with such a complication, and, on the other hand, have seen very severe cases showing the *B. diphtheria* in combination with the more universal staphylococcus. Frequently we find no bacteriological evidence of diphtheria, and, remembering that negative results are not so conclusive as positive, it will be well to have a fresh specimen for examination, as the all-important question of early treatment by antitoxin may be too long delayed. In my experience this remedy is practically a specific if given early and in sufficient quantity. In every case 4,000 units should be given as a minimum, and, even if in doubt as to diagnosis, it is wise to do so, as no harm results, and very little inconvenience, if antiseptic measures are observed; whilst in severe toxæmia the same dose should be repeated in from twelve to twenty-four hours. Doses of 400 or 500 units are worse than useless, as giving a false sense of security, though I have faith in such doses as a prophylactic for those exposed to infection, though the immunity gained does not last long, and I have found typical bacilli in throat swabs from nurses so treated, but who showed no clinical symptoms of the disease, and *en passant* would recommend that every case of diphtheria, however slight, should be kept flat in bed for a fortnight, and the pulse carefully watched for heart failure, which, as is well known, is so common a feature of the disease, not, be it noted, a result of the antitoxin treatment. This lengthy recumbent position is adhered to more in hospital than in private practice, and together with free antitoxin dosage are the chief factors in the more successful results seen there than in home-treated cases.

III.

BACTERIOLOGICAL NOTES FROM FOREIGN JOURNALS.

Blood Examinations for the Malarial Parasite. William H. Knap. (*Journal of Applied Microscopy*, vol. vi., p. 2132.)—Clean a finger or lobe of the ear thoroughly with soap and water, alcohol and ether. Dry and puncture with the blood lancet. Collect a small drop of blood on a clean cover and immediately mount it on a clean slip, blood side down, as a fresh preparation. The drop of blood should be rather small and mounted quickly

so that a thin layer of cells may be observed. The malarial organisms if present may be seen.

Jenner's stain gives good results. Apply as directed in staining blood. The malarial parasites will stain blue.

Thionin is a reliable stain for the organisms of malaria. It is used as follows; Spread a thin film of blood on a clean cover-glass. Immerse it for one minute in 10 c.c. of 95 per cent. alcohol to which one drop of formalin is added at the time of using. Rinse the cover in water, dry between filter-papers and stain for fifteen seconds in 50 per cent. alcohol saturated with thionin, 20 c.c.; 2 per cent. solution of carbolic acid in distilled water, 100 c.c.

Wash off excess of stain. Dry between filter-papers and mount in balsam as usual. Intracellular clear bodies representing an early stage of the development of the parasite are found in all forms of malarial fever. The clear space seen in many red corpuscles, due to the biconcave shape of the cell, should not be mistaken for the malarial organism. In tertian fever a few hours after the chill the ring appears. Pigment usually forms. The rosette and various other forms of the parasite are well stained by these methods.

Collecting, Fixing, and Preserving the Specimen.—In ordinary cases the observer desires to make a mounted preparation of the tissue at once, and in consequence he is interested only in collecting, fixing, embedding, and cutting. To insure uniform and accurate results remove but a small portion of the tissue, not larger than 10 millimetres square and 5 millimetres thick; a much smaller piece would be better. Two or three pieces from different portions of the tissue (growth or tumour or organ) may be taken. Do not wash, but drop immediately into some good fixing solution to kill and preserve the tissue elements as in their living condition. There should be six or eight times as much fixing solution as tissue. Ordinary alcohol may be used, but Carnoy's fluid will give much better results and is more rapid in its action.

It is prepared as follows: Absolute alcohol, 60 c.c.; chloroform, 30 c.c.; glacial acetic acid, 10 c.c.

The tissue should remain in this fluid for four hours. Pour off

the Carnoy's fluid and cover the specimens with absolute alcohol, which should remain half an hour. This should be poured off and fresh absolute alcohol used for a second half-hour. This process washes out the Carnoy's fluid and finishes the hardening of the specimen. It is now ready to embed.

Concerning the Presence of the Bacillus of Eberth in the Blood of Typhoid Patients and its Bearing upon the Prognosis of Typhoid Fever. Jules Courmount. (*Journal of Physiology and General Pathology*, January, 1902; *Bulletins and Memoirs of the Medical Society of the Hospitals of Paris*, January 2, 1902.)—After an historical glance at the question, the author gives a few details upon its technique, and upon observations made in the course of numerous investigations. We give a résumé of the conclusions deduced from this work.

The typhoid bacillus exists in a constant manner in the blood of patients who are suffering from typhoid fever in its ordinary, severe, or fatal forms; the author has no knowledge in regard to the presence in those cases where the attack is either mild or averted. The microbe appears in the blood at an early period, before the fifth day, and remains until the end of the third week. In prolonged cases, or where a relapse occurs, the bacillus of Eberth may remain still longer in the blood, or may disappear. The bacilli obtained from the blood are those of Eberth, with all their specific characteristics; they are, however, only feebly agglutinative; but this feeble power may be developed in subsequent cultures. The presence of the typhoid bacillus in the blood has no bearing upon its power of agglutination. The serum-reaction may be greatly retarded if the bacillus has been found in the blood some time beforehand. Consequently, there is a very valuable method of making a preliminary diagnosis of typhoid fever when the serum diagnosis is negative. This method consists in inoculating 300 to 600 c.c. of ordinary bouillon with 2 to 4 c.c. of blood immediately after it has been taken, and propagating it in the incubator at 37°. In this way a pure culture of typhoid fever may almost always be obtained. On the contrary, the introduction of a few drops of blood into a small quantity of bouillon gives, in nearly all cases, negative results.

CHEMICAL NOTES.

THE DETERMINATION OF CAFFEINE IN TEA. ANDRÉ. (*Bull. de Pharm. de Lyon*, June, 1902; *Ann. de Chim. anal.*, 1902, vii., 427.) —Ten grammes of the finely powdered tea are triturated in a mortar with a milk of 10 grammes of magnesia and 10 c.c. of water, and the mass treated with 100 c.c. of 85 per cent. alcohol, and transferred to a flask, which is heated on the water-bath. After some minutes' boiling the liquid is decanted, and the extraction thrice repeated with 50 c.c. of boiling 85 per cent. alcohol. The united extracts are concentrated to 60 c.c. and filtered, and the filtrate evaporated to a syrup and treated with dilute hydrobromic acid (1 in 1), and again filtered. The new filtrate is treated with 50 c.c. of a solution containing bromine, 50 grammes; potassium bromide, 100 grammes; and water, 850 c.c. The orange-yellow precipitate of tribrom-caffeine hydrobromide ($C_8H_{10}Br_3N_4O_2.HBr$) is redissolved in water, and the solution diluted to 500 c.c. The amount of free bromine is determined in 50 c.c. of this solution, and is represented by v. The amount of free bromine in 50 c.c. of the reagent, diluted with 50 c.c. of water, is also determined and represented by V. Then $10V - 10v$ gives the amount of bromine combined with the caffeine, and the result, multiplied by the factor 0·8083, gives the proportion of caffeine. This method is stated to give results slightly higher than those yielded by Keller's gravimetric method.

METHYLENE BLUE AS A MEANS OF DISTINGUISHING BOILED FROM UNBOILED MILK. F. SCHARDINGER. (*Zeit. für Untersuch. der Nahr. und Genussmittel*, 1902, v., 1113-1121.)—Twenty c.c. of the milk are mixed in a tube, 18 centimetres long and 1·5 centimetres in diameter, with 1 c.c. of a solution containing 5 c.c. of a saturated alcoholic solution of methylene blue and 5 c.c. of 40 per cent. formaldehyde in 190 c.c. of water. The tube and its contents are then placed in a water-bath at a temperature of 45° to 50° C. In the case of unboiled milk the solution is decolorized in about ten minutes, whilst no discharge of colour takes place should the milk have been boiled. The limit-

temperature appears to be about 80° C. A similar methylene blue solution, but without the formaldehyde, is sometimes decolorized, but not always, by raw milk. From bacteriological experiments the author comes to the conclusion that the reaction is due to bacteria ("living protoplasm") in the milk.

On Deguide's Method of Separating Butter from Foreign Fats. G. Deguide, J. Graftian and P. Hardy. (*Bull. de l'Ass. belge.*, 1902, xvi., 336-346.)—In a critical examination of this method (see preceding abstract) the authors found that all the genuine butters produced from February to July left no residue, or only an insignificant one, upon the sieve. Foreign fats, oils (margarine, etc.), however, invariably left a considerable residue, in some cases identical and in others differing in properties from the original sample. In the case of mixtures of butter and foreign fats a residue was left consisting of a mixture of the butter and the fats, in which the proportion of the latter was considerably higher than in the original mixture, this being clearly shown by the refractometer.

Detection of Margarine in Butter by Means of the Phytosterol Acetate Test. A. Bömer. (*Zeit. für Untersuch. der Nahr. und Genussmittel*, 1902, v., 1018-1035.)—The results of a large number of experiments show this method (Analyst, 1902, 94) to be very useful for the detection of vegetable oils, or of margarine containing them, in butter. Whenever the corrected melting-point of the crystals obtained in the last crystallization is 117° C., or above, the sample is undoubtedly adulterated. Should the melting-point lie between 116° and 117° C., the purity of the butter is open to suspicion, whilst if the crystals melt below 116° C. no vegetable oil is present.

A New Method of Detecting Turmeric. A. E. Bell. (*Pharm. Journ.*, 1902, 551.)—The reagent employed is prepared by dissolving 1 gramme of diphenylamine in 20 c.c. of 90 per cent. alcohol and adding 25 c.c. of pure sulphuric acid. A drop of this solution is placed on a microscope slide; a small quantity of the powder under examination is spread over a cover-glass,

and the latter is carefully placed on the drop on the slide, which is then examined under the microscope. Should turmeric be present, purple-coloured spots are observed throughout the field of vision. One part of turmeric in 1,000 parts of mustard, or 1 part in 200 parts of rhubarb, can readily be detected.

THE DETERMINATION OF CARBON MONOXIDE AND CARBON DIOXIDE IN VITIATED AIR. F. JEAN. (*Ann. de Chim. anal.*, 1902, vii., 444-447.)—A known volume of the air is aspirated through an absorption apparatus composed of (A) a flask containing 50 c.c. of a solution of palladium chloride (1 : 1000); (B) a flask containing 5 c.c. of $\frac{N}{2}$ sodium hydroxide and 45 c.c. of water coloured with blue C4B; and (C) a flask containing sulphuric acid (66° Bé.) to retain volatile hydrocarbons and other volatile organic compounds in the air. The palladium chloride is reduced to palladium, and the liquid partially decolorized as soon as 8 to 10 c.c. of carbon monoxide have passed through the flask; whilst 88 c.c. of carbon dioxide are required to change the blue colour in the second flask to red, the volume of air not making any difference in the results in either case. The presence of hydrocarbons and other volatile organic substances is indicated by the sulphuric acid becoming more or less yellow. The amount of air passing through the apparatus being known, the point at which the liquids in the flasks give the reactions enables the proportion of carbon monoxide and dioxide to be readily calculated. The above data were determined with air at 18° C., and by using the formula for the dilatation of air the results can be calculated for air at 0° C. or any other temperature.

A 1 per cent. ammoniacal solution of silver nitrate can be used instead of the palladium chloride solution. It is prepared by adding silver nitrate to an ammoniacal solution of silver nitrate until a precipitate of silver oxide just begins to appear. The author has proved that a filtered solution of the right strength has exactly the same degree of sensitiveness towards carbon monoxide as the palladium chloride solution.

THE ROYAL INSTITUTE OF PUBLIC HEALTH.

LIVERPOOL CONGRESS.

July 15 to *July* 21, 1903.

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Hon. President.

THE RIGHT HON. THE LORD MAYOR OF LIVERPOOL (W. W. RUTHERFORD, ESQ., M.P.).

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SECTION H.

Engineering.

President: George Frederick Deacon, Esq.
Hon. Secretary: J. Brodie, Esq., City Engineer, Liverpool.

SECTION G.

Ladies' Section.

Mrs. Alfred Booth.

PUBLIC HEALTH MEDICAL APPOINTMENTS.

THE following Public Health appointments are announced:

BLAKE, A. F., Esq., L.R.C.P., M.R.C.S. Lond., Medical Officer, Grays Division, Orsett Union.

LYNCH, M. E., Esq., L.R.C.P. Irel., Medical Officer, Clashmore, co. Waterford.

MONCKTON, W., Esq., L.R.C.P. Edin., Medical Officer of Health, Portishead Urban District Council.

DIPLOMA IN PUBLIC HEALTH.

Conjoint Examination in Ireland by the Royal College of Physicians and the Royal College of Surgeons in Ireland.—W. H. Hornibrook, L.R.C.P. and S. Irel.; T. M. Keegan, M.A., M.B., B.Ch., R.V.I.; J. McNiesh, M.B., B.Ch., R.V.I.; J. B. Stephenson, M.D. Durh.

MEDICAL STAFF COLLEGE.

THE Secretary of State for War has approved of the appointment of the following physicians or surgeons as clinical teachers to the Medical Staff College:

Medicine.—Dr. S. J. Sharkey (St. Thomas's Hospital); Dr. W. Hale White (Guy's Hospital).

Surgery.—Mr. A. Pearce Gould (Middlesex Hospital); Mr. Stanley Boyd (Charing Cross Hospital).

Dental Surgery.—Mr. J. H. Badcock (Guy's Hospital).

Dermatology.—Dr. T. Colcott Fox (Westminster Hospital).

Laryngology.—Mr. F. J. Steward (Guy's Hospital).

Midwifery and Gynæcology.—Dr. W. R. Dakin (St. George's Hospital).

Ophthalmology.—Mr. E. Treacher Collins (Royal London Ophthalmic Hospital).

Otology.—Mr. A. H. Cheatle (King's College Hospital).

Pædiatrics.—Dr. A. E. Garrod (Hospital for Sick Children, Great Ormond Street).

Psychological Medicine.—Dr. M. Craig (Bethlem Royal Hospital).

Pathology (Professor).—Major W. B. Leishman, R.A.M.C.

ROYAL ARMY MEDICAL CORPS.

THE following have been appointed Lieutenants in the Royal Army Medical Corps: A. R. Smallman, P. Davidson, D.S.O., W. B. Taylor, A. H. Hayes, R. B. Ainsworth, R. Storrs, F. A. H. Clarke, G. W. Smith, T. M. H. Conway, H. V. Bagshawe, C. V. B. Stanley, W. W. Browne, W. D. C. Kelly, W. C. Rivers, W. F. Tyndale, C.M.G., J. McKenzie, N. D. Walker, H. J. Crossley, C. A. J. A. Black, R. L. V. Foster, E. A. K. H. Reed, J. W. Sucombe, S. M. W. Meadows, D. S. Skelton, H. G. S. Webb, R. Rutherford, N. C. J. Harding, R. J. Franklin.

LEAD-POISONING AND WATER-SUPPLIES.

IN 1895 the Medical Officer of the Local Government Board issued an interim report on "Lead-Poisoning referred to Public Water-Supplies derived from Moorland Sources," which showed that such poisoning was known to have existed at one time or another among a large population in the North of England. Dr. Houston was entrusted with the task of ascertaining the conditions which increased or diminished the liability of a given moorland water to act on lead pipes, and the factors which governed the difference between soft moorland waters, some of which are, others of which are not, capable of dissolving lead.

Peat water is always acid, and dissolves lead in proportion to its acidity, which is governed by the length of time the water has been in contact with the peat. Moorland spring water is neutral, and often possesses slight acid neutralizing ability. The acidity of any quantity of mixed water may be reduced by increasing the quantity of spring water, if it be possessed of the acid-neutralizing power.

It is possible to guard against this plumbo-solvency by excluding from the supply contributory waters which are known to be conspicuously and uniformly acid, and by mechanical contrivances to prevent the "first washings" of peaty soil after-draught having access to the supply.

The erosion of lead, which is an inherent property of waters containing dissolved oxygen, is not an intrinsically dangerous quality of a water, unless under special conditions and in the presence of bright lead.

The most satisfactory method of neutralizing acid water which possesses this dangerous power of plumbo-solvency is ordinary sand filtration, with the addition of some neutralizing material (*e.g.*, a thin coating of lime on the surface of the sand, with limestone underneath the sand) to the filter, and the subsequent addition of a trace of sodium carbonate to the neutral filtered water.

The volume is a comprehensive survey and account of the investigations conducted by Dr. Houston into this very important question of the relation of lead-poisoning and water-supply.

REVIEWS.

The Estivo-Autumnal Malarial Fevers. By Dr. C. F. CRAIG (Yale). Baillière, Tindall and Cox. Price 10s. 6d. net.

This book, from the pen of a distinguished surgeon of the United States Army, is a valuable addition to the literature on malaria, though we may be permitted to hope that in his next edition some further recognition will be made of the results of the investigations into malarial fever which have from time to time been carried out by the Government of India. It is quite clear that the last word has yet to be said on this subject. Sanitarians are agreed, with a fair degree of unanimity, on the prophylactic measures which science has declared necessary, but the question, when it comes to practical administration, very largely becomes one of expense. Dr. Craig's experience of malarial fevers was extensive and varied, and we welcome this monograph on a very important group of diseases.

Manual of Toxicology. By A. H. BRUNDAGE, M.A., M.D. Baillière, Tindall and Cox. Price 6s. net.

This is an admirably arranged manual, which will be found of great use not only to students who may wish to acquire a knowledge of toxicology for examination purposes, but to the practitioner in his daily work, to the lawyer engaged in poisoning cases, and to the expert in his laboratory. It is a complete and trustworthy summary of modern research on this subject, and deals with the various poisons in a practical manner which presents facts with a lucidity which is too often conspicuous by its absence in books of this kind.

Aids to Sanitary Science. By F. J. ALLAN, M.D., D.P.H., and R. A. FARRAR, M.A., M.D., D.P.H. Ballière, Tindall and Cox. Price 4s. 6d.

This is a second edition of Dr. Allan's well-known and useful manual, and, as stated in the preface, advantage has been taken of the demand to bring it up to date in conformity with modern knowledge and the requirements of students. It is a thoroughly practical work, and deals concisely but clearly with a large array of facts, which are thus made accessible to the student and to the practical man.

Essays on Consumption. By J. E. SQUIRE, M.D., D.P.H. The Sanitary Publishing Co., Ltd., 5 Fetter Lane, E.C. Price 10s. 6d.

These essays date from 1889, the first in order, though not in date, being one which appeared in *The Journal of State Medicine*, 1892. They deal lucidly and comprehensively with this important subject, and strike throughout a note of encouragement to those who are occupied with hygienic reform; for Dr. Squire is one of those who hold that consumption is to a very large extent a disease which may be firmly checked by simple prophylactic measures. Perhaps the time will come when the opposition to public health measures will be condemned as malignant or ridiculed as foolish; but in the meantime books like this serve a most useful purpose in disseminating sound knowledge, and, with wise moderation, proclaiming useful truths.

Biographic Clinics. By Dr. G. M. GOULD. Messrs. Rebman, Ltd. Price 5s. net.

This work opens with an analysis of the clinical symptoms recorded in the authentic biographies of five famous English men of letters—De Quincey, Carlyle, Darwin, Huxley, Browning—all of whom suffered from maladies which obstinately baffled all remedies. The author demonstrates to his own entire satisfaction that the professional diagnosis was in each case wrong, in that it omitted consideration of eye-strain, a factor to which he assigns an importance of the first degree. The book is, in short, a treatise on eye-strain, and with many of the author's remarks as to the imperative necessity for periodic and skilled examination of the eyes of young children we are in complete accord. The author has an interesting style and an interesting subject, but if his intention be to convince, to persuade, to win disciples, he might find it wise to give us more clinics and a little less biography.

A Manual of Hygiene. By W. H. HAMER, M.A., M.D., Lecturer on Public Health, St. Bartholomew's Hospital; Assistant Medical Officer, Administrative County of London. J. and A. Churchill.

This is a well-written manual, which leaves untouched no subject of any importance in connection with hygiene. The book is illustrated, and the type used is clear. Dr. Hamer knows what the candidate for a Public Health Diploma requires, and has succeeded in producing a work which can be strongly recommended to the attention of all who are in any capacity interested in the administration of Public Health affairs.

BOOKS, JOURNALS, REPORTS, ETC., RECEIVED.

THE Council desire to acknowledge with thanks the receipt of the following books:

1. *From Messrs. Baillière, Tindall and Cox:*
"The Estivo-Autumnal Malarial Fevers," Craig; "Aids to Sanitary Science," Allan and Farrar; "Manual of Toxicology," Brundage.
2. *From Rebman, Ltd.:*
"Biographic Clinics," Dr. G. M. Gould.
3. *From the Sanitary Publishing Company, Ltd.:*
"Essays on Consumption," J. E. Squire, M.D., D.P.H.
4. *From the Authors:*
"Pulmonary Consumption," Dr. Arthur Latham; "Manual of Hygiene," Dr. W. H. Hamer; "Boyle" System of Ventilation.

Also the following:

The Lancet; The British Medical Journal; The Sanitary Record; The Surveyor; The Medical Times and Hospital Gazette; The Pharmaceutical Journal; The Councillor and Guardian; Albany Medical Annals; Glasgow Medical Journal; Public Health; The Journal of Applied Microscopy; The Journal of the Society of Chemical Industry; Egésyég; La Salute Pubblica; The Journal of the Sanitary Institute; Water; The Journal of Tropical Medicine; Journal of Balneology and Climatology; Tuberculosis; The Thirtieth Annual Report of the Local Government Board—Supplement; Dr. G. S. Buchanan's Report to the Local Government Board on Epidemic Small-pox in the Union of Orsett, 1901-02; Board of Agriculture Leaflet; The Reports of the Medical Officers of Health, East Stow Rural District Council, Stowmarket Urban District Council, Chelmsford, Maldon, Kingston-on-Thames; Report of Medical Officer of Health to the London County Council as to Houses let in Lodgings; Minutes of the General Medical Council, vol. xxxix.; The Proceedings of the Clinical Society.

Letters, Notes, Queries, etc.

Communications respecting Editorial matters should be addressed to "THE EDITOR, JOURNAL OF STATE MEDICINE, 19, Bloomsbury Square, W.C." *Those concerning business matters, non-delivery of the* JOURNAL, *etc., should be addressed to* "THE SECRETARY, The Royal Institute of Public Health, 19, Bloomsbury Square, W.C."

The agents for advertisements appearing in THE JOURNAL OF STATE MEDICINE are Messrs. Van Alexander and Co., 8, Paternoster Row, E.C., Telephone No. 1404, Holborn, to whom all communications with reference to advertisements should be addressed.

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Telephone number of The Royal Institute of Public Health, No. 1614 Central.

The Journal of State Medicine.

THE OFFICIAL ORGAN OF
THE ROYAL INSTITUTE OF PUBLIC HEALTH.

VOL. XI.] APRIL, 1903. [No. 4.

A FEW FACTS CONCERNING REFUSE DESTRUCTORS.*

BY

W. FRANCIS GOODRICH,
Of London.

IT has been customary to preface a paper of this kind by setting forth the high sanitary standard of the ancients in striking contrast to the prevalent apathy on sanitary matters in these days. A friend of mine, writing recently for the *Electrical Review* on "Refuse Destruction, its Sanitary and its Steam-raising Aspects," eulogizes the Scythians, Phrygians, North American Indians, Greeks, and Romans, and a few more, but he makes an exception of the Christians, whom he tells us abandoned the destruction of their refuse about the end of the fourth century.

Well, I do not propose delving into ancient history; it will not help us. Sixteen centuries ago the existent conditions did not demand the erection of the destructors as the only means of satisfactory disposal, but in these days it is generally admitted that there is only one final, sanitary, and satisfactory method of dealing with the by-products of existence.

We live in a sanitary age, and although glaring instances of shortsightedness may occasionally occur, giving fresh courage to the pessimist, yet, on the whole, we are steadily moving in the right direction, and, poor as our record may appear under close scrutiny, yet the fact remains that in final and sanitary refuse disposal we lead the world—and it is a long lead, too, as

* A paper read at the Exeter Congress, 1902.

those who are conversant with American and Continental methods will be well aware.

During the past three years inquiries for destructors have been numerous and constant from all parts of the country, and I shall not exaggerate if I say that within the period named more destructors have been adopted than during the preceding nine years. This is very satisfactory so far, but let us not boast; statistics show only too clearly that although great progress has been made, much yet remains to be done.

It is strange, but true, that many important towns still without destructors enjoy those modern luxuries, electric light and electric traction. Supporters can readily be found for such improvements as these, and rightly, too, so far; but how about the filth of the community? Is it not, to say the least of it, very incongruous to thus improve a town in its lighting and travelling facilities while you placidly continue to tip hundreds of tons of filth as near the boundaries as possible, or inflict it on other communities foolish enough to take it?

I am reminded of "dear, dirty Dublin," a city with over 250,000 inhabitants, and an alarming death-rate, spending hundreds of thousands of pounds on electricity schemes within the past two years, while the refuse is a constant source of trouble, being tipped both on land and at sea. A small destructor of the old type was erected many years ago, but it is only capable of dealing with about one-seventh of the total refuse produced.

A committee of the Local Government Board, as the result of an inquiry into the public health of Dublin, two and a half years since, recommended that additional destructors be erected; but while expensive electricity schemes go forward, urgent sanitary reform is neglected.

Take the seaside and health resorts of England and Wales, 124 in number, all popular places, and what do we find? Twenty-one only have adopted destructors, and some of these are of old types.

Now, many of these places are excellently managed municipally in some respects, particularly in the provision of attractions to lure those in search of health and recreation, but there seems

to be a strange hesitation about tackling sanitary reform. Many excellent councillors like to forget about the refuse—there is but little glamour about filth—but, forgotten or not, it accumulates, spoiling many a lovely landscape and giving endless annoyance.

Those who have been through the Isle of Wight will doubtless have seen many accumulations of filthy refuse. A year since I took some photographs of a 5,000-ton heap a few yards from a

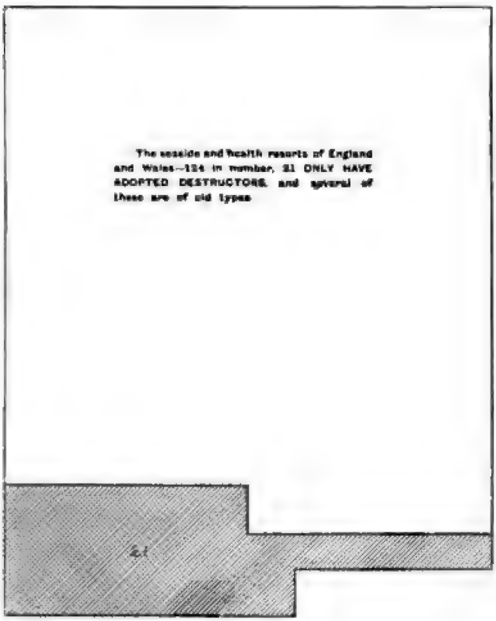

FIG. 1.

main road, and only three miles from Osborne House; at the time several large pigs were feeding on the vile mixture. So much for health resorts; now we will look into other figures, which are also shown in diagrams Nos. 1 to 6.

Of the twenty-eight Metropolitan boroughs, twelve only have adopted destructors, half of which have been in use many years, and are of old types. The remaining sixteen London boroughs still continue to inflict their filth on other communities. Only

within the past few weeks the City Corporation have decided upon a most retrograde and inconsistent step by purchasing a large tract of marsh land at Hornchurch, Essex, to which place the refuse will be barged and tipped. At the same time they decided to erect a crematorium—in short, to bury the refuse and burn the dead.

Of the thirty-two great towns of England and Wales with populations exceeding 100,000 each, twenty-two only have adopted destructors; and of the forty-three towns with populations exceeding 50,000, but under 100,000, twenty-two only have adopted destructors.

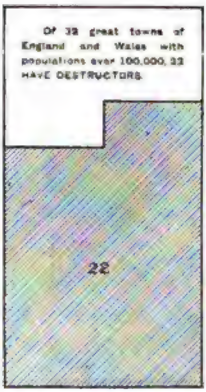

FIG. 2.

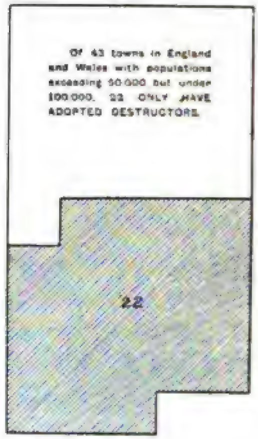

FIG. 3.

There are 103 towns with populations exceeding 25,000, but under 50,000, and thirty-nine only have adopted destructors.

Of 253 towns with populations exceeding 10,000, but under 25,000, twenty-five only have adopted destructors; and, lastly, out of 262 towns having populations exceeding 5,000, but under 10,000, nine only have adopted destructors.

As time goes on the character of refuse changes; in many places where farmers used to take refuse for agricultural purposes they will not take it now under any circumstances, and

their attitude is scarcely to be wondered at, as refuse has certainly decreased in manurial value, largely owing to the quantity

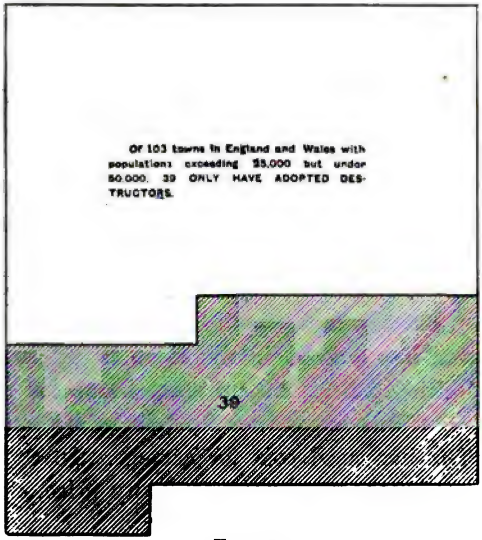

FIG. 4.

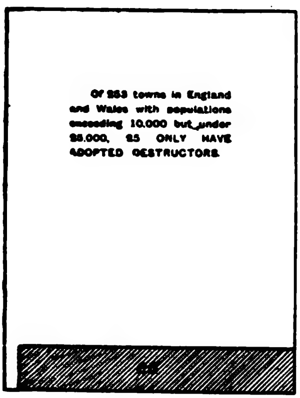

FIG. 5.

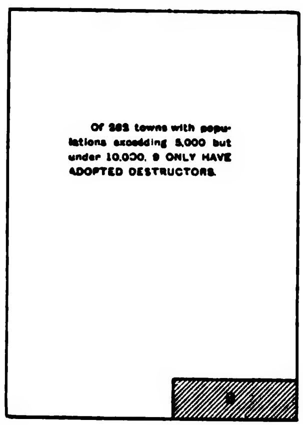

FIG. 6.

of tins and bottles of every kind which now find their way into the ashpits.

The farmer must be allowed to know his own business best, and his attitude should be satisfactory to the sanitarian, at any rate, in so far that it has the effect of forcing the sanitary authorities to face their responsibilities.

The disgusting practice of tipping refuse finds but few defenders at the present time, and their number dwindles. Those who still recommend the tip as a rule take great care that they do not reside near one, and—shall I say it?—these economically minded citizens are often the very people who write sharply to the surveyor on Tuesday because their refuse was not collected on the Monday.

Some would have us believe that a refuse-tip is almost a salubrious spot, but the fact remains that land for the purpose cannot as a rule be obtained in the High Street, or, indeed, in any central position. No; the tip must be as far removed as possible, and, as towns expand, a tip has to be found further from the town at increased cost for cartage. In some districts landowners are loth to allow tipping at any price, either far or near.

It is indeed strange that many who profess no open objection to a refuse-tip are greatly alarmed if it is proposed to erect a destructor on or near the same site. It is impossible to cater for these people: they must be ignored.

I must confess to living quite near to a 20,000-ton tip myself, and, while I cannot say it is a source of offence to me, as it is well looked after chemically, yet at the same time I think it very hard to pay a stiff rent and high rates for the privilege of living near to what may, without exaggeration, be called an eyesore and a disgrace to a respectable neighbourhood. I am pleased to say that this particular tip will be treated as perhaps no other large tip in this country has yet been dealt with—the refuse will be removed in small quantities daily and destroyed, with the current collection of refuse, when the destructor which has been decided upon is erected.

Refuse tipping is serious enough in this country, but how much more so must it be in some tropical cities? In some of the large cities of South America, for instance, refuse-tips are still being

added to which have been in existence for one hundred, and even two hundred, years. Think what this means in populous cities in the Argentine, Chili, and Peru, where the refuse is in many respects more objectionable than that produced in this country. Notwithstanding that it is generally admitted to be telling its tale in the death-rate, little is being done to remedy the trouble.

In India the authorities are almost equally apathetic, although it is generally admitted that the refuse disposal problem is exceedingly acute. In Australasia three modern high-temperature destructors have been erected within the past few months. Tipping has been a source of great annoyance, and is surely doomed. We shall see great developments in the Antipodes, and that before long. The people are practical, and sanitary progress has perhaps a more potent meaning to the average citizen in Australia than anywhere else in the civilized world.

Returning to our own land, is it not remarkable that great towns such as Portsmouth and Cardiff are still without destructors? According to a recent report, 85,387 tons of refuse in Cardiff is disposed of yearly on two tips. Cardiff, like Dublin, is well to the fore in electric lighting and traction; the same may also be said of Portsmouth.

Other similar cases might be cited—there are many of them. It is not the fault of the surveyor or the Medical Officer of Health. Again and again, from end to end of this country, and in other countries, too, do these public officials recommend the adoption of destructors, and in many cases, to say the least of it, they are not thanked for their suggestions.

It is quite true that, on the whole, refuse destructors never before enjoyed such popularity as they do to-day, and if the field is only left to the practical and experienced, there is no doubt that we shall see a large increase in the number of towns adopting refuse destructors within the next few years.

The intelligent citizen is now beginning to realize that a modern destructor, properly worked, may be erected in the most central positions without causing any nuisance whatever. The Local Government Board clearly appreciate the destructor of to-day,

and they constantly sanction the application for loans, even when it is proposed to erect the destructor on central sites and adjacent to good property.

It is strange, but true, that the opposition met with at Local Government Board inquiries comes from those who have never seen a destructor of any kind. They will sometimes unblushingly admit this when cross-examined; but of what avail is it, for they will continue to talk as long as the inspector's patience lasts. Some assume tragic attitudes and prophesy ruin for owners of property adjacent. Others almost weep in their pathetic efforts to convince the inspector that the terrible innovation is not wanted, and that the old methods are still the most suitable. Sometimes a chance question has the effect of showing that these curious hostile witnesses are not ratepayers; but, like the immortal brook, their misguided eloquence, if I may so term it, still flows on.

The extraordinary activity displayed by some citizens in their opposition to the installation of a refuse destructor is almost incredible. Some time ago, when I was attending a Local Government Board inquiry in the Midlands, it actually came out in evidence that a resident in the town was so very anxious to discover conclusive evidence of nuisance from destructors that he travelled over a hundred miles to see a destructor. While in the town he examined the spouting and gutters of a place of worship situated about half a mile from the destructor. To his great joy, he found some dust, which was produced at the inquiry. It was alleged, of course, that this dust, which was doubtless obtained at risk to life and limb, and as the result of much acrobatic effort, was from the destructor chimney; but on examination it was found to be nothing of the kind, but that black, gritty dust which comes from coal.

The town where this particular destructor is in use is a busy manufacturing centre with scores of tall factory chimneys, and this misguided witness might have found quantities of dust, such as he produced, on the pavement in any part of the town. Incredible as it may seem, this incident is true, and it serves to show how stupidly hostile some intelligent citizens are, and how

they will at times bestir themselves to resist an urgent sanitary improvement.

Only about a year since I had a case in hand—a town of about 16,000 inhabitants, within fifty miles of London, where eighty tons of refuse is produced per week, this being collected and disposed of by a contractor at a cost of £26 per week.

The town in question is surrounded by land owned by the War Department and the Admiralty, and consequently it was all but impossible for the contractor to find any suitable tip. So difficult did the problem become that the council resolved to erect a destructor on their own land at the water-works in the centre of the town, this site offering two advantages: firstly, minimum cost of collection, and, secondly, the only available outlet for utilizing the power produced from the refuse.

The site is a remarkably central one, being surrounded by houses. Overlooking the council's yard is a large school, and at the Local Government Board inquiry a solemn-looking witness appeared, opposing the application. In a most pathetic speech he assured the inspector that his motives were not selfish, but that he came to plead the cause of the children, that their health and, maybe, their lives, would be jeopardized if the dreadful destructor was erected upon the site chosen. He had not seen a destructor—oh no!—but yet he was most mournfully persistent in his efforts to save the lives of the 500 children.

Now for the other side of the case. By erecting a destructor on this site, sufficient power will be available to operate the deep well pumps for the town's water-supply, saving a coal bill of over £500 per annum. Again, by reason of the site being central, the cartage cost will be very low, and the work of collection will be done expeditiously and thoroughly, as is usually the case when refuse is looked upon as fuel.

The *net* result at Sheerness—for this is the town I am referring to—will be a reduction of one penny in the rate after paying all expenses.

Let us now take another case which I have had in hand, namely, that of Weymouth. Here a refuse destructor is to be erected at the sewage works, which, unlike most works of this kind, is

situated in a very central position. Here the cartage cost will be considerably reduced, and a coal bill of £400 per annum will disappear entirely. The gain to Weymouth will be, firstly, final and sanitary disposal; secondly, a net reduction to the extent of 1½d. in the rate, after making every reasonable allowance.

I wish it to be clearly understood that the appended figures showing how the installation of a destructor at Weymouth will actually reduce the rates do not represent the fanciful dream of the destructor maker. Mr. W. Barlow Morgan, A.M.I.C.E., the Borough Surveyor, is responsible for the figures, and careful perusal will show that every allowance has been made.

Borough of Weymouth and Melcombe Regis Destructor.

	£	s.	d.
Estimated Annual Cost and Repayment of Loans:			
Brickwork in destructor	1,750	0	0
Buildings	1,290	0	0
Road	160	0	0
	3,200	0	0
Loan for Twenty Years:			
Machinery and ironwork	1,400	0	0
	4,600	0	0
Annual Cost:			
£4,600 at 3 per cent.	138	0	0
Sinking Fund 2½ per Cent.:			
£3,200 at thirty years	72	12	9
£1,400 at twenty years	54	14	9
	265	7	6
Estimated Annual Saving to the Rates:			
To present cost of coal used at pumping station	476	0	0
Estimated saving of two horses and two men per day Collecting refuse (7s. 6d. per diem)	234	0	0
	710	0	0
To the value of 1,250 tons of clinker at 2s. 6d.	156	5	0
	866	5	0

Deductions:

To interest and sinking fund ...	£265	7	6			
Increase in working staff (two stokers at 24s. each per week) ...	124	16	0			
				390	3	6
				476	1	6

Net assessable value, £99,650; rateable value, £92,000; 1d. in the £ produces £356; £476 = 1·33d., say 1¼d. in the £.

The installation of a refuse destructor cannot always be looked upon as a certain means of reducing the rate, or, indeed, of making any profit at all, but I do say that what will surely be done at Sheerness and Weymouth could be done in many other towns in this country, always providing, of course, that the destructor is erected on a central site, and that the power can be fully utilized.

Destructors continue to be adopted in connection with electricity works, and there is much to recommend the combination.

Firstly, the site is invariably fairly central; hence low cartage cost. Secondly, it is possible to use the available power from the whole of the refuse at an electricity works.

On the other hand, sewage works are, as a general rule, not centrally situated, but on the outskirts; and, as a consequence, if the whole of the refuse has to be carted to that point, the cost, of collection may be heavy. Again, generally speaking, one-third to one-half of the total refuse available, if destroyed in a good destructor, is sufficient to provide the power required normally.

If the electricity works has a good, steady day motor load, or if power is required for traction, this offers a unique opportunity for effective combination, as at Shipley.

The erection of a destructor at a sewage works is a most excellent combination, and my previous remarks must not be interpreted as being derogatory to the combination. I merely state the obvious fact that, as a general rule, sewage works are not

centrally situated, while, on the other hand, electricity works are usually erected in central positions.

At Hereford, Aldershot, Shipley, Nuneaton, and many other towns where destructors have been erected at sewage works the result has been highly satisfactory, not one pound of coal having been used since the destructor was installed. It has been said that sewage works are not paying concerns, invariably having a charge on the rates, and that if money is to be saved let the sewage works benefit, and not the electricity works, which should pay its way; at any rate, we are always given to understand that electricity works will be a source of profit.

Now, what is being done with refuse at electricity works? Firstly, Mexborough, Shipley, and Wrexham must be named as being towns where electricity for public purposes is actually produced from refuse alone, no coal whatever being used.

It is interesting to note the actual output in electrical units at various combined electricity and destructor works. I will just mention a few.

Shipley, average for the month of January, 1902, 37·4 units generated per ton of refuse destroyed.

St. Helens, average for one year, 37·3 units generated per ton of refuse destroyed.

Darwen, average for one year, 33 units generated per ton of refuse destroyed.

Accrington, average for the month of November, 1901, 19·9 units generated per ton of refuse destroyed.

Wrexham, average for the month of November, 1901, 37·8 units generated per ton of refuse destroyed.

These are authentic figures, and, covering as they do reasonable periods, they may be taken as a really valuable guide as to the possible success of the combination.

Short tests have been severely criticised, and rightly, too, but average figures taken over one month or one year should satisfy the most exacting.

If the best modern destructors were not free from nuisance, it would be impossible to consider their erection on central sites;

but our best modern practice all goes to show that a destructor can be so designed as to be entirely free from nuisance, and those who still look askance at the destructor as a power-producer must not forget that the particular destructor which is most successful in its primary duty of destroying every form of refuse without nuisance is usually the most satisfactory as a power-producer, for very sound and logical reasons.

To secure the thorough destruction of refuse a high temperature is absolutely necessary—not occasional high temperature, but a continuity of high temperature, the fluctuations being confined within the narrowest possible limits. Those with only an elementary knowledge of the subject will agree that this is the great essential, and the success of the destructor as a destructor depends entirely upon the continuity of high-temperature working. Similarly, the value of a destructor in its secondary duty, the production of power, also depends upon the attainment and continuity of high temperature.

On the other hand, the destructor which either does not reach a high temperature, or with which the temperature fluctuates seriously, is not likely to be satisfactory as a destructor, and it will be equally unsatisfactory as a power-producer, because fluctuating temperature in the main flue or combustion chamber soon tells its tale on the steam-pressure gauge of the boiler and in the engine-room.

The best modern destructors maintain a fairly even temperature, and therefore are valuable in their secondary duty as power-producers.

Having insisted upon the importance of continuity of high-temperature working as absolutely necessary to insure the success of the destructor, both in its primary and secondary duties, it will now be useful to examine into those conditions which must obtain in order to effect the object in view.

The ordinary single-cell system, either as arranged for top or back feed, is not the ideal system for easy maintenance of high-temperature working, for reasons which I will endeavour to make clear.

With this system, either as arranged in single row or back to

back, each cell as a cell is isolated and distinct from its neighbour—that is, so far as the actual work within the cell is concerned, one cell is not of the slightest assistance to its neighbour on the right or left.

Further, during the clinkering, charging, and levelling processes the temperature of a single cell may fall 1,000° F., the walls and the crown arch becoming practically black, and it is obvious that the fresh charge of refuse cannot ignite readily, but instead distils slowly, and the large volume of low-temperature gases, as driven off, enter the main flue and absorb heat there, thus sensibly lowering the temperature as a whole.

This happens if a plant is properly worked, the cells being charged and clinkered in rotation. If the plant is not properly worked it is easy to see that the temperature in the main flue may be greatly reduced, with a consequent liability to nuisance and coincidently inefficient steam raising.

Now, if we take another system—that of twin cells, or cells erected and worked in pairs—there must at once be a decided advantage, because the alternate charging and clinkering, with one cell out of the two always in full work and at its greatest heat, while its fellow is being clinkered and charged, and with one combustion chamber common to the two cells, it will be easy to see that greater efficiency is possible. Mr. Deas, of Warrington, introduced this principle, which is still embodied as an essential feature of the Beaman and Deas destructor. That it does conduce to the maintenance of high temperature in the combustion chamber is well-known, and this explains why this type of destructor has been so popular.

Mr. J. S. Highfield, the Borough Electrical Engineer of St. Helens, in a paper read before the Municipal Electrical Association last year, on the subject of combined destructor and electricity works, insisted upon this principle as being absolutely necessary for destructors erected in connection with electricity works. Why? Simply because a fairly constant high temperature is essential.

Meldrum's system of continuous grate with divided ashpits carries out the same principle, but on a much broader and more

comprehensive basis, as I will proceed to explain. With this system a destructor unit is one cell only; the grate may be 6 feet long, or it may be 20 feet long, according to the desired destroying capacity. In the former case two ashpits or distinct closed compartments are provided under the grate, or, in the latter case, four distinct ashpits, with a spacious combustion chamber at one end.

With the large cell, or, as it is termed, four-grate unit, one-fourth of the grate or cell is clinkered and charged at one time, the other three-fourths of the grate or cell being in full work. In fact, the brickwork of the cell is always incandescent. The gases as distilled from any portion of the grate freshly charged are ignited and rendered innocuous in the cell, where the temperature is fairly constant. The actual working of this continuous grate may be clearly seen by referring to the four diagrams, Nos. 7 to 10. If we commence by charging No. 1—that fourth section of the grate on the extreme left—it will be seen that the remaining 75 per cent. of the grate and cell on the right is in full work. The refuse being fed on to section No. 1 in small quantities, immediate ignition of the material is secured, and the gases as distilled in their sideway motion must pass over and intermingle with the heated volume passing from sections Nos. 2, 3, and 4, the whole volume then entering the combustion chamber.

If we now charge section No. 2 in its turn, it will be seen that the freshly charged material is in a zone of active fire, 25 per cent. of the cell on its left and 50 per cent. of the cell on its right being in full work. When we charge section No. 3 it will be seen that one-half of the cell on the left is in active work, and one-fourth on the right; ignition of the freshly distilled gases must take place; the action is automatic and cannot be helped. Now, coming to section No. 4, when we charge that portion, three-fourths of the grate on its left are discharging their heated gases over the newly charged section. Nothing could be more simple; thorough cremation in the cell itself is secured automatically. It will be observed that there is no isolation, and in this respect the system is diametrically opposite to single isolated cell-systems.

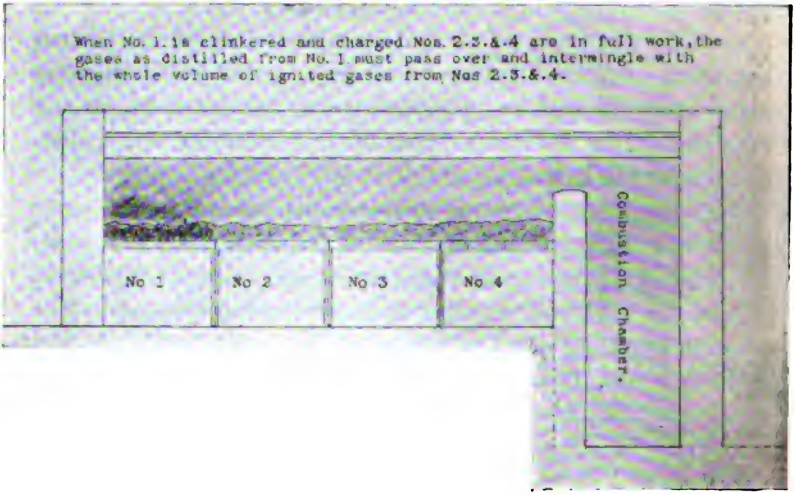
When No. 1. is clinkered and charged Nos. 2.3.&.4 are in full work, the gases as distilled from No. 1 must pass over and intermingle with the whole volume of ignited gases from Nos 2.3.&.4.
No 1
No 2
No 3
No 4
Combustion Chamber.

FIG. 7.

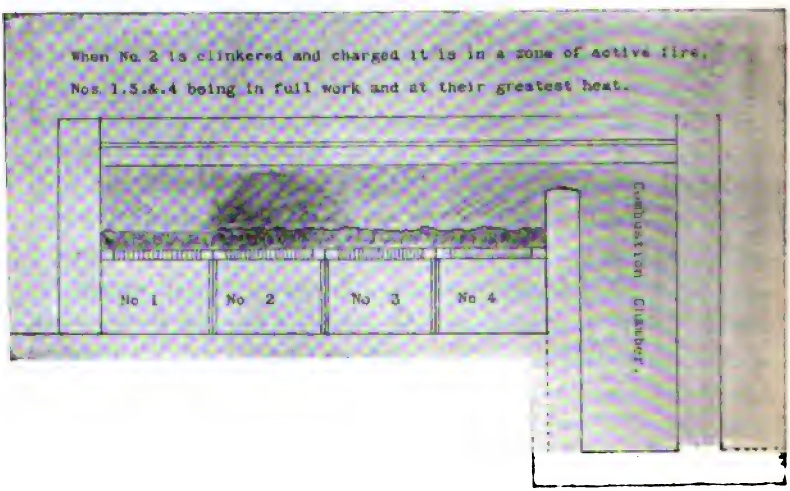
When No. 2 is clinkered and charged it is in a zone of active fire, Nos. 1.3.&.4 being in full work and at their greatest heat.
No 1
No 2
No 3
No 4
Combustion Chamber.

FIG. 8.

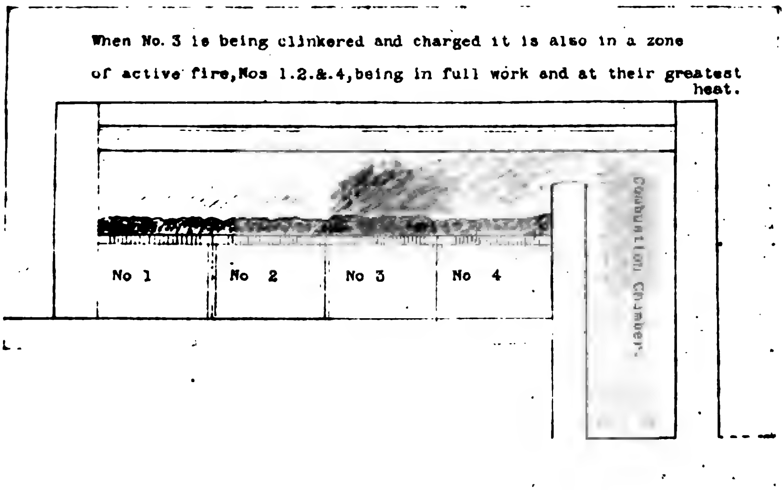
When No. 3 is being clinkered and charged it is also in a zone
of active fire, Nos 1.2.&.4, being in full work and at their greatest heat.
No 1
No 2
No 3
No 4
Combustion Chamber.

FIG. 9.

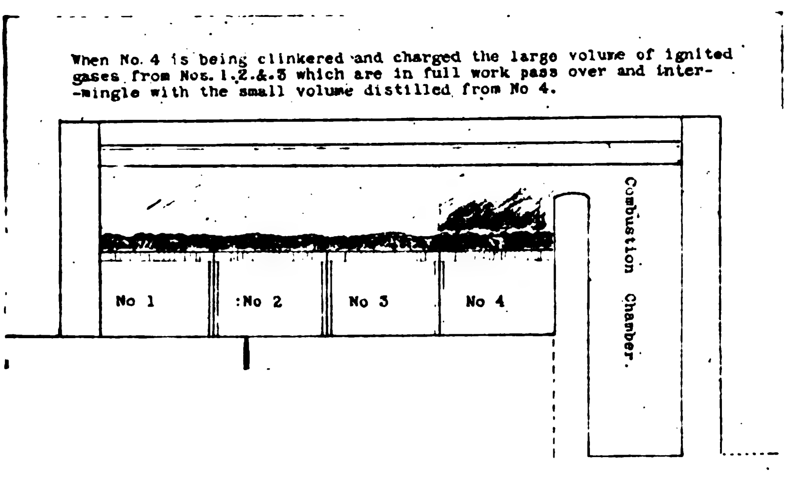
When No. 4 is being clinkered and charged the large volume of ignited gases from Nos. 1.2.&.3 which are in full work pass over and inter-mingle with the small volume distilled from No 4.
No 1
:No 2
No 3
No 4
Combustion Chamber.

FIG. 10.

This system of working, the refuse being hand-fed, and the air for combustion being supplied heated up to a temperature of 350° F. by means of the continuous regenerator, effectually secures a uniform high temperature, first in the cell itself, and then in the combustion chamber. As the forced draught is always in use with three-fourths of the grate, cold air is not admitted, and the percentage of CO_2 in the gases is high.

Among the latest destructors on the market is a furnace or cell which is said to be worked at such a remarkably high temperature that the incombustible residuum is reduced to considerably less than 10 per cent. This destructor has not yet been installed anywhere in this country, so far as I am aware, but it is, nevertheless, claimed that the well-known makers are all wrong, and that this new competitor will soon leave them all far behind. We shall see: time will tell; those who know anything about combustion will require some very substantial evidence before they will be brought to believe that the incombustible can be destroyed.

(To be continued.)

THE ACTION OF THE BACTERIOLOGICAL TREATMENT OF SEWAGE UPON TYPHOID BACILLI.*

BY

RANSOM PICKARD, M.D., F.R.C.S., D.P.H.

WHILST preparing a preliminary report upon the septic tank system for the Exeter City Council in April, 1896, it occurred to me to endeavour to ascertain as exactly as possible the action of the system upon typhoid bacilli when introduced into sewage. The importance of this is obvious; for sewage practically gives trouble only in two ways, as an offence to the senses and as spreading disease. However disagreeable sewage may be to the senses, its power of reproducing disease is far more important, and it is easy to conceive that a system of sewage purification might be very good in the sense of getting rid of those parts of sewage which are offensive and yet it might not interfere at all with the disease organisms contained in the sewage.

Messrs. Laws and Andrewes presented a report to the London County Council in 1894 upon the behaviour of typhoid germs in sewage sterilized by heat or by filtration, using a broth culture for their experiments. There was a slight increase at the end of twenty-four hours, and by the end of a week the bacilli were almost extinct.

Klein afterwards experimented with a culture made upon agar at 37° C. and then diffused in saline solution before being added to the sewage. Other workers have tried to ascertain quantitatively or qualitatively the action of sewage upon contained typhoid bacilli when added to earth, but the intrinsic difficulties of the problem have prevented much advance in our knowledge of this subject.

My work consisted of three parts: (*a*) The action of sewage sterilized by heat upon typhoid germs grown upon gelatine; (*b*) the action of crude sewage upon typhoid germs; (*c*) the action of intermittent filtration upon typhoid germs previously exposed to crude sewage for forty hours in warm weather.

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* A paper read at the Exeter Congress, 1902.

The action of sterilized sewage proved to be somewhat variable. The sewage was obtained from a sewer which contained no trade refuse. It was collected about 11 a.m., and was filtered through one layer of filter-paper into a flask, and then sterilized by heat for half an hour at 100° C., and from one to five days.

There was no connection found between the number of times the sewage was heated and the destruction of bacilli. Thus, in Experiment I. it was heated five times, and 63 per cent. were destroyed in forty hours, while in No. II. it was heated once, and 67 per cent. were destroyed. But there is an obvious connection between the age of the gelatine culture and rapidity of destruction, for the same culture was used for all the experiments, and the older the culture the greater the destruction in the sewage.

Date of Experiment, 1896.	Number of Times Sewage was heated.	Initial Number of Typhoid Bacilli per 1 c.c.	Final Number per 1 c.c.	Duration of Experiment.	Tempera-ture of Room.	Percentage surviving at End of Experiment.	Percentage surviving at Forty Hours (obtained by charting).	Age of Culture.
				Hours.	Centigrade.			Days.
I. May 21	5	1,367,000	341,500	47	17·4°-14·4°	25	37	3
II. " 27	1	234,000	69,500	42	20°-12·7°	29·7	33	9
III. " 28	2	2,202,500	348,000	41	"	18·07	20	10
IV. " 29	3	747,500	125,000	40	"	16·7	16·7	11

The experiments on crude sewage were not started till later in the year, when cold, wet weather had set in, and the sewage was much diluted by storm-water. The idea underlying them was to imitate as closely as was possible in a laboratory experiment the two stages in the treatment of sewage by the septic tank process, an initial stage in which the sewage is kept in a dark tank practically deprived of oxygen, and a second stage in which the tank effluent is gradually poured on a filter-bed, allowed to remain in it at rest for awhile, and then discharged, the filter-bed then having a period of rest. The method used for detecting the typhoid bacilli was that given by Laws and Andrewes. Dilutions of the sewage in saline solution were cultured on agar at 37° C.,

the colonies subcultured in milk at 37° C.; the milk-tubes which coagulated were rejected, and the remainder subcultured on gelatine slopes. The colonies which resembled typhoid and the *Bacillus coli* were subcultured in gelatine shake cultures and in broth. Those which gave no bubbles in the former nor indol in the latter were assumed to be typhoid bacilli.

Typhoid Bacilli in Crude Sewage.

The sewage was collected at noon on December 5, 1896, the coarse particles allowed to subside, and the fluid poured into a bottle. Typhoid bacilli from a twenty-four hours agar culture at 37° C. were introduced, and the whole well shaken for five minutes. An estimation was then made, the bottle tightly stoppered, and placed in a dark box in the air at a temperature varying from 2° C. to 3·5° C.

Time of Estimation.	Number of Typhoid Bacilli per 1 c.c. of Sewage.	Percentage of Original Amount introduced.
Initial	10,900,000	100·00
24 hours	8,300,000	76·14
32 „	7,700,000	71·28
48 „	6,600,000	60·55
7 days	890,000	8·16
14 „	80,000	·73

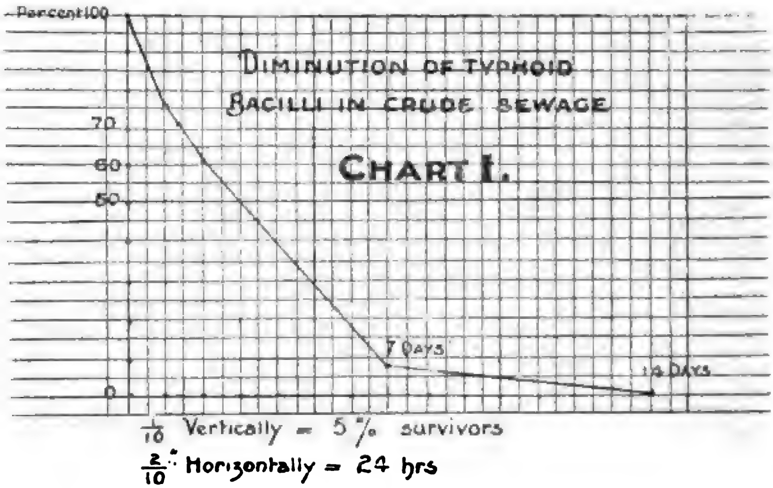
It will be seen that there is a steady and fairly regular decrease in the number of typhoid bacilli for the first week, but after that the rate of decrease slows down, though still considerable. The early stages are those upon which I wish to lay stress. There is no initial increase, but a steady diminution from the beginning.

Intermittent Filtration.

A series of experiments were next carried out to imitate the action of a filter-bed. A cylindrical galvanized iron tube, 4½ feet long and 1 inch in diameter, was closed at the lower end by a stopcock. It was filled to a depth of 4¼ feet with coke breeze which had been in use in the filter-beds at the septic tank

installation at Exeter for some weeks, so that it had already acquired biological properties.

By means of a syphon 6½ ounces of effluent from the septic tank was run into the tube containing the filtering material, the time taken for the flow being an hour and a half. After nine hours from the time the effluent started running in, the tap was turned and the fluid allowed to escape. The filter was allowed to drain and remain empty till the cycle of twenty-four hours had passed by, and then effluent was again passed in. This cycle represents a nearly as was possible what happened in the installation at



Exeter during the dry, warm weather at that time. Six and a half ounces of effluent was chosen because it was nearly equal to the amount which would be poured on ·795 of a square inch of the filters at Exeter, the sectional area of my tube being ·795 of a square inch.

The rate of flow from my filter was very unequal, for 5½ ounces came off in the first hour, and the remainder trickled away in the course of several hours. It would not have done to have waited till the whole had come through, for that would have given time for the typhoid bacilli to have sensibly diminished in the filtrate; so the estimation of the filtrate was made at the end of an hour after the tap had been turned on, and it was assumed that the

result represented also the amount in the portion of the filtrate which came away more slowly. The error involved in this assumption would cause an overestimate of the number of bacilli surviving, for the last portions would have been exposed a longer time to the action of the filter.

My filter-tube was daily treated with tank effluent for three weeks before the typhoid experiment was made.

August 27, 1896.—Sewage was taken at 11.30 a.m. at Belleisle, Exeter, and allowed to stand till 8.30 p.m., to allow the coarse particles to subside, and then 6½ ounces were poured into a sterile flask. Typhoid bacilli from a two-day-old agar culture were added, and the whole shaken. The flask was then kept in the dark at room temperature for forty hours.

August 29, 1896, 12.30 *p.m.*—Estimation of typhoid. The effluent was then syphoned into the filter in about three equal portions, at 2.40, 5.50 and 7 p.m. respectively, in order to imitate the slow filling of the filter-beds.

11.35 *p.m.* — Tap turned. Filtrate estimated for typhoid bacilli at 12.40 a.m., *August* 30, 1896, when 6 ounces had come through. This is called the "first filtration."

August 30, 1896, 11 *a.m.*—Tank effluent from Belleisle was passed into the filter-tube, and let out at 8.20 p.m. The filtrate was estimated at 9.40 p.m. for typhoid bacilli. This is called the "second filtration."

August 31, 1896, 12 *noon.*—Effluent passed into the tube; let out at 8.55 p.m., and estimated at 10 p.m.—the "third filtration."

	Number of Colonies sub-cultured from Agar Plates.	Number of Typhoid Bacilli per 1 c.c.	Percentages in Filtrates.
Sewage and typhoid bacilli (forty hours)	136	7,090,000	100
1st filtration - -	132	762,000	10·747
2nd filtration - -	47	100,000	1·41
3rd filtration - -	33	35,000	·494
			12·651

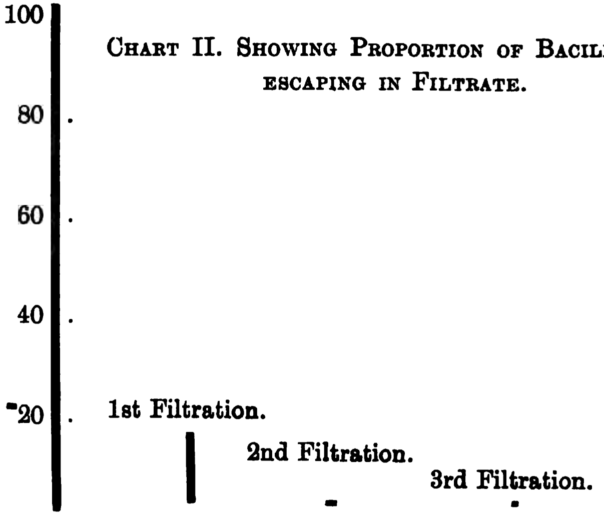


CHART II. SHOWING PROPORTION OF BACILLI ESCAPING IN FILTRATE.

There is a considerable decrease in the number of typhoid bacilli in passing through the filter-tube. In part this is mechanical; the irregular shape of the filtering material would tend to hold back some portion of the bacilli, and that this is so is shown by typhoid bacilli appearing in subsequent filtrations. But if the action were wholly mechanical, a much larger proportion should have appeared in the second and third filtrates. For 89·203 per cent. do not come through with the first filtrate. The disproportion between this and 1·41, the percentage in the second filtrate, is too great to allow of any other conclusion than that a large proportion of the typhoid bacilli are actually destroyed in the filter-tube.

The fallacies underlying these experiments will be referred to later, but, assuming they represent the state of affairs in the tank and filter-beds, it may be stated that a biological system such as the septic tank system destroys a distinct proportion of the typhoid bacilli which may be present in sewage. Some are killed in the tank, and others probably have their vitality diminished, so that exposure in the filtering-beds much more easily kills them than if the sewage were passed directly on to the filters. It is not possible from the experiments made to

state with any exactness the proportion destroyed under all variations in the duration of stay in tank and filters, dilution of sewage, alteration of temperature, etc.

The filtration experiment was made for a cycle of twenty-four hours in the filter-beds, corresponding with a stay of forty hours in the tank. This stay in tank would give a survival of 66 per cent. (see Chart I.) approximately. By proportion we find that 8·35 per cent. of the original number would appear in the first three filtrates. If this number were increased by bacilli coming through in subsequent filtrations to 10 per cent., this would still give a destruction of 90 per cent. for this given stay in the tank and filters.

There are several fallacies which must be remembered in making exact deductions from these experiments as to the action of tanks and filters. The main one is that the number of typhoid germs introduced vastly exceeds any possible contamination by the excreta of typhoid patients. To a certain degree this could be overcome by using a much weaker dilution of typhoid bacilli to add to the sewage. But even in the large proportion used the work was most laborious, the number of subcultures from the original plates great, and the further cultivations for the successive tests took up much time. In two respects the circumstances of the experiments militated against tho destruction of the typhoid germs. The filtering material was not quite so deep as in the septic tank installation—$4\frac{1}{4}$ feet as compared to $4\frac{1}{2}$ feet—and the smallness of the tube gave a smooth surface, down which the fluid could run quickly without being subjected so thoroughly to the biological action of the filtering material, and a surface much larger in proportion than the walls of an actual filter.

It has been suggested that the agglutinating powers of the serum from typhoid patients might be used as a test to confirm or supplant those used in this work, but the difficulty in obtaining it in the amount required, and the indecisive character of negative results, would greatly militate against its usefulness. Until a simple but conclusive test for typhoid bacilli is introduced which can be used for quantitative results, some laborious

method, such as that used in this work, seems the only way towards the solution of the problem of the destiny of typhoid bacilli in sewage.

In conclusion, it is hoped that the mention of the work of others in this paper has shown that no originality is claimed for the methods used, but it seemed worth while to communicate the results, as the biological treatment of sewage bids fair to become very general, and I do not happen to have seen any account of the behaviour of typhoid germs under these systems. The work done deals only with a small part of the whole question, but the spare time of a general practitioner is too scanty to allow of its completion.

PRESERVATIVES IN FOOD.

THE Board of Health, New South Wales, has published amended regulations under the provisions of the Public Health Act, including the following:

"(*a*) Any one antiseptic or any one antiseptic preparation may be mixed with any food in proportions not exceeding one one-thousandth of one grain per pint in the case of liquid foods and of one one-thousandth of one grain per pound in the case of solid foods: provided that the label required by Section 86, subsection 2, of the Act to be affixed to the vessel or parcel containing food mixed with antiseptics or with antiseptic preparations in accordance with this regulation be in the form given in Schedule L, and be printed on a white ground in black capital letters of the size known as 'two-line brevier sans serif,' and contains no other matter. (*b*) The following substances shall be deemed to be antiseptics and antiseptic preparations for the purpose of this regulation: Formaldehyde and its preparations, boric acid and its preparations, hydrofluoric acid and its preparations, sulphurous acid and its preparations, benzoic acid and its preparations, salicylic acid and its preparations, and derivatives of coal-tar, whether direct or indirect."

RECENT PRACTICE IN REFUSE DISPOSAL AND UTILIZATION PLANTS.*

BY

FRANK LESLIE WATSON, Assoc.M.Inst.C.E., A.R.I.P.H.

At the Dublin Congress of this Institute, in 1898, I had the honour of reading a paper on "The Designing and Construction of Refuse Destructors." I propose now to briefly outline some of the results of more recent experience. The general principles to be aimed at in a refuse disposal and utilization plant are the same whenever and wherever destruction by fire is to be adopted, and the desirability or otherwise of any particular make of destructor depends upon the extent to which they are carried into effect. I place those general principles in the following order:

1. High temperature in furnaces and flues, with complete combustion of all solids on the grate.

2. Complete exposure of all gases produced by combustion and distillation of the refuse to the highest temperature before they are permitted to escape from the furnace.

3. The prevention of the escape of dust to the chimney. The foregoing are the primary necessities in a destructor from the point of view of the sanitarian. As, however, sanitary engineers must be economists as well as scientists, these further points must be borne in mind :

4. Economy in working, principally in relation to the labour bill, but also in relation to cost of maintenance and repairs.

5. Utilization of the heat produced by the burning of refuse.

6. Utilization of the thoroughly burnt clinker.

7. Reasonable first cost must also be considered, but in this, as well as in every other engineering matter, the lowest price is generally to be avoided.

It must be borne in mind that when tenders are invited for refuse disposal plant each patentee is offering his own speciality. The conditions are, therefore, totally different from those which

* A paper read at the Exeter Congress, August, 1902.

obtain when an engineer or architect issues a set of drawings and quantities for a building, or a sewer, or a new road. It may easily happen that the firm which asks the highest price is giving much greater proportionate value than the firm which asks the lowest, and that if the lowest tender be accepted the contractor will make a greater profit than would the contractor who sends in the highest tender, provided always that the contractor succeeds in fulfilling his guarantees and getting paid for his plant. It is a not uncommon error to suppose that the firm which offers the highest pecuniary penalty in case of failure is the most reliable. The inventor, however, is proverbially sanguine, and, in attempting to introduce a new and untried scheme, will usually agree to any conditions which may be proposed in order to get the scheme adopted, his faith in his own inventions being in inverse ratio to his experience of their results. Complicated mechanisms, designed to save labour, are frequently brought forward in connection with these plants. It should always be remembered that the conditions under which a destructor works are all against the success of mechanical arrangements situated within the furnace. Every appliance, whether for opening or closing doors, producing the necessary forced draught, or charging or clinkering the furnace, should be of the simplest and most direct character. An apparent economy is often entirely discounted by the cost of maintenance, and, what is still more serious, by the stoppage of the works during repairs. I had, some years ago, a very striking object-lesson when I inspected, preparatory to reconstruction, a large and costly destructor plant which was a total failure simply through the introduction of a hopper feed and a moving grate bar, which have both worked well in coal-fired boilers for many years. In case of any electrical plant being used for hoists, cranes, or other purposes, unusual care must be exercised in casing the whole mechanism, owing to the presence of fine, gritty dust in the atmosphere, which is an unavoidable factor in the working of destructors.

There has grown up recently a strong tendency to lay much stress upon the results of short evaporative tests; some have even been published showing very high figures taken on a six

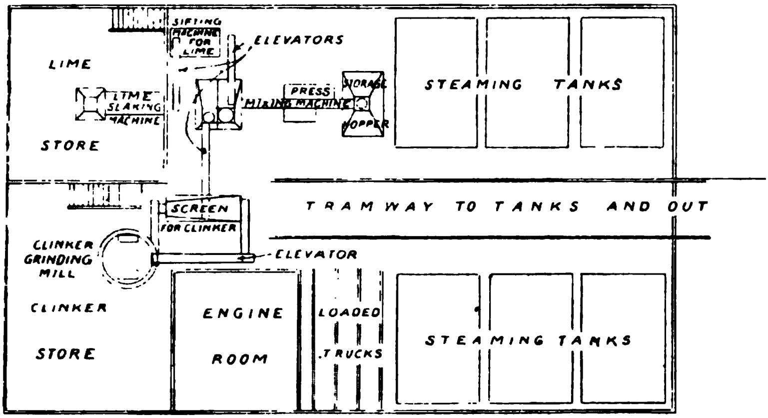


FIG. 1.—DR. SCHULTESS'S PATENT CLINKER BRICK-MAKING PLANT.

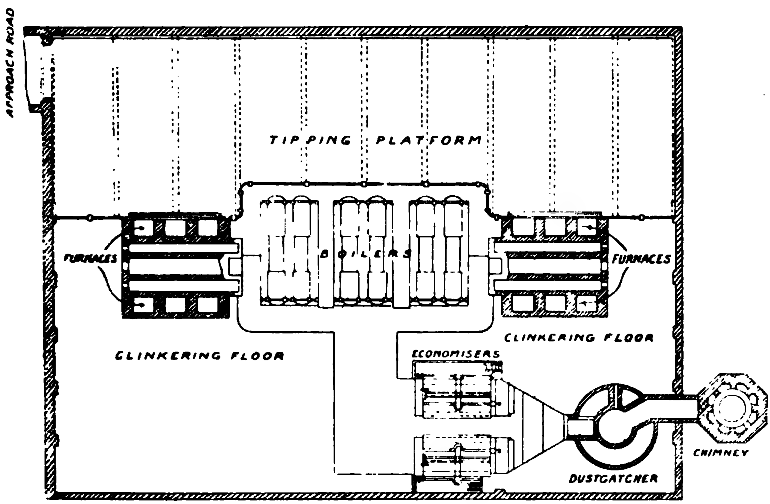


FIG. 2.—TWELVE-CELL DESTRUCTOR, METROPOLITAN BOROUGH OF FULHAM.

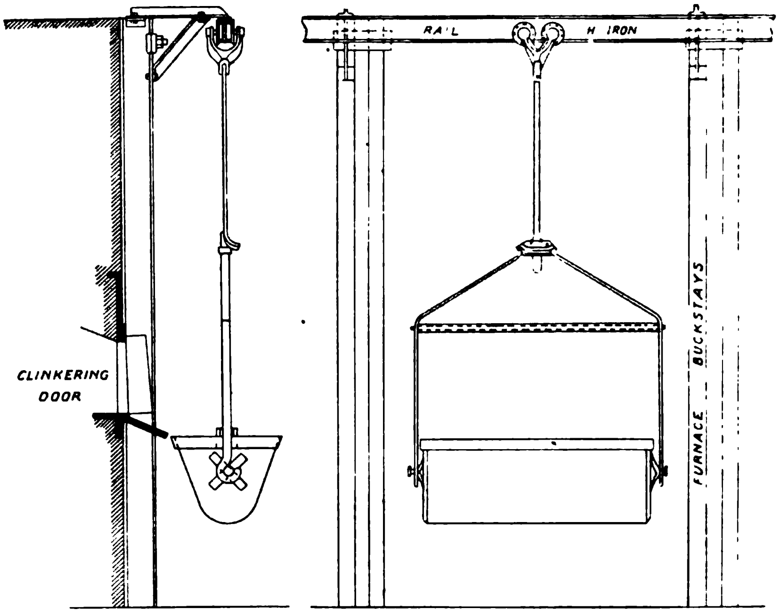


Fig. 3.—Cox and McTaggart's Patent Clinker Railway.

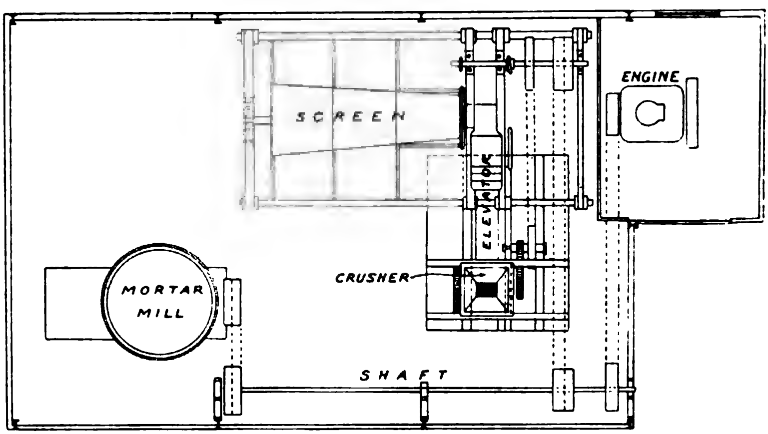


Fig. 4.—Arrangement of Clinker-Crushing Machinery.

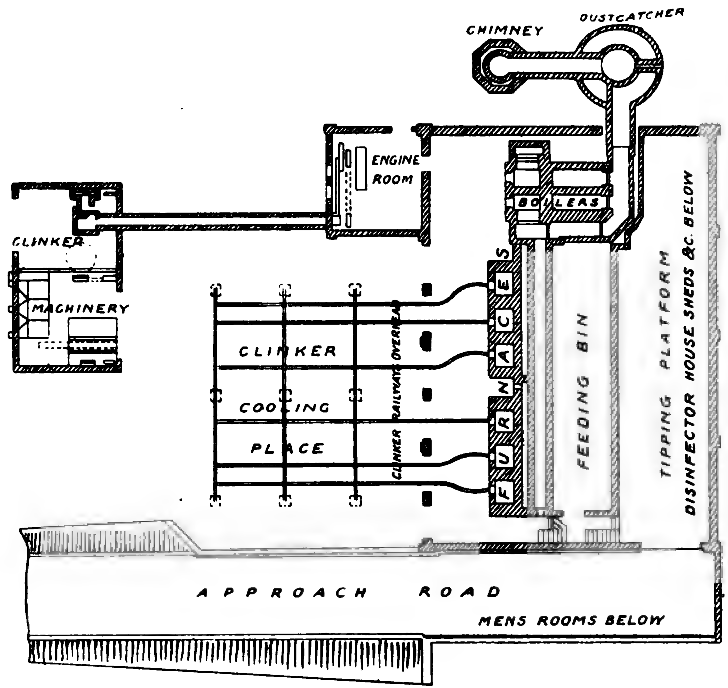


FIG. 5.—SIX-CELL DESTRUCTOR, MOSS SIDE, MANCHESTER.

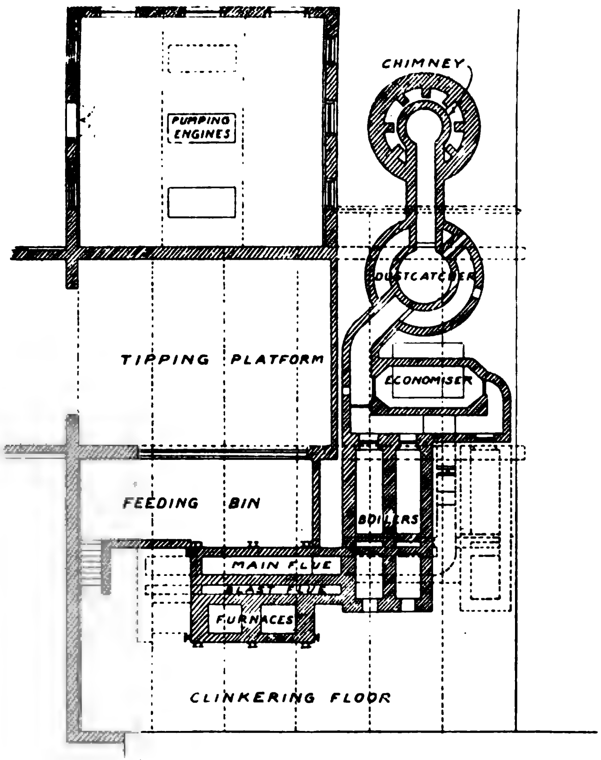


FIG. 6.—TWO-CELL DESTRUCTOR, SALISBURY.

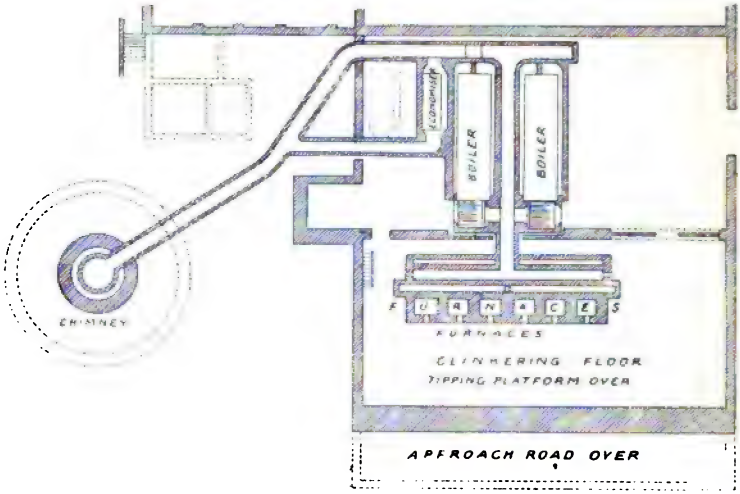


Fig. 7.—Six-Cell Destructor, Accrington.

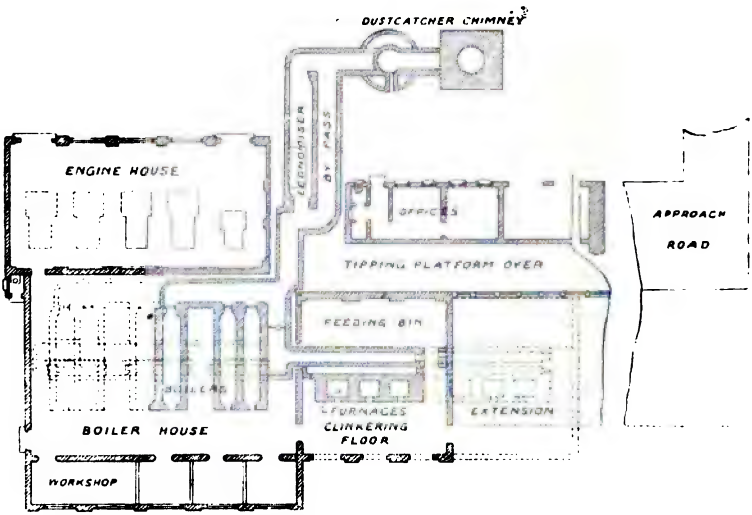


Fig. 8.—Three-Cell Destructor, Beckenham Electric Light Station.

hours' run. No destructor test of less than a full working day of twenty to twenty-four hours is of any value whatever, and, personally, if I could pick my staff, I would undertake to obtain on a six hours' run almost any result which may be asked for. I would always recommend the adoption of plant which has been tried by experience in preference to plant on which even superlative results have been obtained for a short period. In saying this, I am not, of course, condemning minor departures from, or improvements on, tried systems, when such departures grow out of experience, so that their results can be foreseen with certainty. One consequence of the publication of results based on brief experience is that the whole system of refuse disposal by fire is to some extent discredited by the failure to fulfil exaggerated and fanciful estimates, and we have the most respected of our engineering periodicals opening its pages to serious discussion as to whether or not it is of any use to attempt to utilize the steam from a destructor, or whether the additional cost of the boilers is not sufficient to deter a municipality from the attempt. It is often forgotten that the principal factor in steam raising with any modern destructor is not the name of the patentee, but the calorific value of the refuse, which varies enormously in different towns. A safe figure to be taken as a basis is that an evaporation of 1 lb of steam per pound of refuse may usually be confidently predicted, and if this figure be adopted as a basis for estimates it will frequently be exceeded in practice, with the result that those responsible will have the credit of exceeding their estimates instead of the discredit of failing to fulfil them. The power thus obtained is being utilized in this country for varied purposes. Among these are municipal electric lighting, pumping of sewage, heating of public baths and wash-houses, driving of tramways, manufacture of mortar and concrete flags, and grinding and sifting material for concrete and plastering. It will thus be seen that in laying out a destructor plant sound mechanical knowledge and experience are very necessary, as well as a knowledge of destructors in themselves. Several types of boiler are in successful use in connection with destructors. Good results have been obtained from "Lancashire" boilers, "Multi-

tubular" boilers, and water-tube boilers. On the whole, I prefer the water-tube boiler for several reasons. In the first place, it lends itself much more readily to building into a brick flue for gas-firing purposes than any other type. In the second place, steam is raised much more rapidly in a water-tube boiler. This is highly important, because the destructor itself cannot work at full power until the forced draught is applied, and in most cases that cannot be done until steam is raised in the boiler attached to the destructor. This difficulty can be overcome by providing a coal-firing furnace to the boiler, but the quantity of coal or coke burnt to get up steam should be kept as low as possible. It is, again, very easy to provide such a coal-fired furnace in a water-tube boiler, and very difficult to provide it in a Lancashire boiler. In the latter case it involves a separate brick erection outside the boiler, which is exposed to radiation, and which usually serves to admit quantities of cold air to the flues while the destructor is working, and so reduces its steam-raising powers.

For the removal of the clinker from the furnaces a very convenient system is that which was first adopted at Hammerton Street, Bradford, and patented by Mr. Cox and the late Mr. McTaggart. As now constructed, it consists of an overhead single rail formed of an H iron. Usually a separate rail is laid direct from each furnace to the point at which the clinker is to be tipped for cooling or crushing. On the lower flange of this rail runs a trolley having four wheels with ball bearings, and from the trolley a bucket is suspended, capable of containing a full charge from one fire. The rail is so arranged that the bucket comes up under the lip of the dead-plate, to which the bucket is temporarily fastened by means of hooks, and the clinker is drawn direct into the bucket, which is then run away on the rail with the greatest ease, and with infinitely less labour than is involved on the system usually in vogue.

For the utilization of the clinker, a special arrangement of crushing mill, also introduced and patented by the late Mr. McTaggart and Mr. Cox, has been adopted with satisfactory results. The crushing mill consists of a pair of fluted rollers cast

with a chilled face, geared together, and driven by strong double helical spur wheels, the rollers having a special elastic attachment to their spindles to prevent undue shock. The crushed material is taken up by a chain belt elevator and delivered into a revolving screen, which divides it up into four or more different sizes as required. The crushed clinker may now be used for concrete making or plastering, according to size, and in many instances it is found that in its crushed and graded condition the clinker is an extremely saleable article without further manipulation. A very important machine for utilizing the clinker is the mortar mill. Owing to the extreme hardness of the material with which it has to deal, the mill should be much more strongly constructed than is usually the case, and should weigh half as much again as the ordinary mortar mill used in builders' work.

For the manufacture of flags from crushed clinker further machines are required, and, although these are in successful operation in quite a number of towns, the first cost of a flag-making plant is so heavy as to deter many Corporations from the investment. A flag-making plant consists of a grinding machine, for which purpose the mortar mill answers very well, in which the clinker is crushed very fine and mixed with a due proportion of cement and water, from whence, in a semi-fluid state, it passes into the moulds of the hydraulic flag-press. This, of course, involves the provision of a hydraulic pumping engine and an accumulator. The pressed flags are carefully stacked in racks which prevent warping and twisting while drying. A steam drying chamber as hereafter described in connection with the brick process is a useful adjunct to a flag plant, as the seasoning, which ordinarily takes weeks, may then be effected in forty-eight hours.

The process of manufacturing bricks from crushed material has been more highly developed on the Continent than here. An excellent system is that introduced by Dr. Schultess, director of a large brickworks at Zurich, where the plant is in successful operation. Tests of the crushing strength of bricks manufactured at Zurich show that they are superior in strength to good clay bricks. A special point about this system is that common lime

may be used, and that the proportioning and mixing of all the materials is so thoroughly carried out that the best possible results are obtained. The plant consists of a lime-slaking machine, in which the slaking is effected by means of a small quantity of moisture and by the aid of low-pressure steam. Thus all excess of water in the slaking process is avoided, and hydrated lime is obtained as a dry powder. The slaked lime is delivered by a conveyer to a screen, where any foreign matter is rejected, and from thence into the dividing machine, where the proportioning of the lime and clinker is effected; thence the materials pass to a mixing machine, where the exact quantity of water is introduced to give them the plasticity necessary for the moulding process, which is carried out by a power press similar to that used in making clay bricks, but much more powerfully constructed and capable of exerting a far greater pressure. The formed bricks or slabs are conveyed to the steaming chambers, where they are subjected to the action of saturated steam at atmospheric pressure during about forty-eight hours, after which period they can be taken out completely seasoned and ready for use.

The most important and successful electric lighting and destructor plant hitherto erected is that of the Fulham Corporation, which consists of a twelve-cell destructor provided with six water-tube boilers, the furnaces being arranged in two blocks of six cells each, with the range of six boilers between the two blocks. There are also two fuel economizers behind the boilers, and a centrifugal dust-catcher. A general plan of this plant is shown. The cells are of the "back-to-back," "top-fed" type, the general construction being similar to that of the furnaces at Hammerton Street, Bradford, described in my paper of 1898. Some considerable improvements in detail have been introduced, which need not be enumerated here. The gases from each block of six cells can be led to any pair of boilers, and the boilers are provided with mechanical stokers and with forced draught; thus the boilers which are not being fired with destructor gases can be fired with coal, and *vice versâ*. The results obtained from the burning of refuse are thus kept quite distinct from those due to any coal which may be used, and there is no room for the endless

discussions which have taken place in some other instances as to whether or not any steam was raised by the refuse, or whether it was all raised from coal. The steam-pipes pass from the boilers to the electric light engine-house adjoining. The destructor is provided with an overhead railway of special design, by which the clinker is removed direct from the furnaces to the river side. It can also be tipped in the yard if required. No plant for the utilization of the clinker has yet been installed. It will be seen from the plan shown that the general design of this plant is complete and convenient, and it has been fully justified by the excellent results obtained, both in steam raising and in economy of working.

Another important and successful electric light station is that at Accrington, where there are six cells of similar type to those at Fulham, but arranged in a single row. Two Lancashire boilers are provided, one of which is fired with destructor gases, while the other may, if required, be coal-fired. The boilers are 30 feet long by 8 feet in diameter, and the steam pressure is 200 lb. per square inch. A fuel economizer is introduced behind the boilers, and, as will be seen from the plan, special efforts have been made to keep the boiler as close to the destructor as possible, although, in putting up a Lancashire boiler, this point always involves a difficulty. The results obtained from this plant have been excellent, the whole of the electric lighting having been run for considerable periods without the use of any fuel other than refuse. I may mention, incidentally, that although it used to be said that the temperature of the gases was not high enough to produce high-pressure steam, no difficulty at all is experienced in keeping up 200 lb. per square inch. Clinker conveying, crushing, and screening plant is at present being erected on this destructor, which will, of course, be driven by steam from the destructor boiler.

At the Beckenham electric light station a three-cell "back-fed" plant has been erected, working in conjunction with water-tube boilers, the general scheme of which is shown on the plan. At this plant the electric light engines have been driven for prolonged periods without the use of any coal, and the British Insulated

Wire Company, who are running the plant on a contract with the District Council, have, I understand, no doubts whatever as to the economy resulting from the combination.

I also exhibit a plan of a six-cell "back-fed" destructor which has recently been completed at Moss Side, a suburb of Manchester, and which is, I venture to think, an excellent example of a well-arranged plant, put up primarily for refuse disposal, and the whole available power of which will ultimately, though not at present, be utilized. There are two water-tube boilers, and at present the only outlet for the power is in driving a complete clinker crushing and screening plant. The smallest size of broken material is used for plastering, the next larger size for sprinkling the roads in slippery weather, and the two largest sizes for concrete. A pan-mill is also installed, in which mortar is manufactured.

A good example of a combined destructor and sewage pumping plant is that at Salisbury, where a two-cell destructor is attached to two water-tube boilers, the steam being utilized for the sewage pumping plant. As compared with electric lighting, sewage pumping has one advantage in that it provides usually a constant load on the boilers. It is usually much more convenient to run a destructor night and day at its normal rate, and in the case of an electric light plant this frequently means that during the day the heat is not fully utilized.

A recent development is the direct tipping from refuse carts into the furnace without any handling. A six-cell plant on this principle has been erected at Shot Tower Wharf, opposite to Somerset House, for the Corporation of Westminster, which, since the initial difficulties inseparable from a new design have been overcome, is giving entire satisfaction; a similar plant, with the latest improvements, is being constructed for the Corporation of Blackpool, which thus justifies its reputation for being in the van of sanitary progress, as all health resorts should be.

I have refrained from giving detailed results of the working of these plants, considering that subject somewhat outside the scope of this paper, which has already reached a sufficient length, but so far as I am able I shall be pleased to give particulars of such results to any member who may desire them.

THE SOIL AS A MEDIUM FOR THE CONVEYANCE OF SOME DISEASES.*

BY

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THE field open to the worker in medical and sanitary science is almost without limitation, being, as it is, comprehensive enough to embrace not only the cure of disease, but also its prevention and suppression.

In the early days of medicine the empiric was content to assume that the encompassment of his sphere contained only the injunction to him to use his phlebotomy instruments and physic in the hope, and doubtless the belief, of curing disease.

The medical practitioner and veterinary surgeon of a later period not only attempted to cure disease by more enlightened measures than those of his predecessor, but devoted much of his time and attention to the study of how best to suppress outbreaks of disease. From this time onwards it was impossible to stop the advance, and this was the inception of what is now the most important part of our professional education—namely, Preventive, or, as it is sometimes called, State Medicine.

Although there is at all times reason to fancy that this arena is monopolized by medical men, still we, as veterinary surgeons, play by no means an unimportant part, as from our knowledge of the diseases of animals—especially those transmissible from the lower animals to man—we are able, by recommending suppressive and preventive measures, not only to strictly limit the spread of disease among animals, but to remove a more than possible source of infection to man. Indeed, I might go further, and assert that, were more opportunities given us—as might be done by the appointment of Veterinary Officers of Health—our professional knowledge would be felt to be an immense power for good in the administration of Public Health laws and regulations.

* A paper read at the Exeter Congress, 1902.

In preventive veterinary medicine there is great scope for investigation, from the study of the etiology of disease to the application of antiseptics and disinfectants to retard or destroy the vital activity of those micro-organisms pathogenic in character. Under this heading there is no more important study than that of the soil as a medium for the transmission of disease from one animal to another, and to ascertain how it may become contaminated from the living animal or from a carcass.

It has long been known that surface-soils are very rich in micro-organisms, and that only a certain proportion of these are pathogenic, while many others are positively useful for the life and growth of vegetation.

The number and species of these organisms depend upon—

1. Climatic influences.
2. The composition of the soil.
3. The depth from which the sample has been taken.
4. Whether the soil has been cultivated or not.

It has been found that after severe cold weather the number of organisms on or near the surface has decreased, while in the lower layers the number has not perceptibly diminished, the reason advanced for this being that the soil seems to act in a protective manner and afford some degree of shelter. The depth from which a sample of soil has been taken has a marked influence on the numbers of bacteria, as on the surface and in the immediate lower layers they are most numerous, while they are becoming very rare at a depth of 5 or 6 feet.

The composition or character of the soil has also a direct bearing upon the presence of organisms, as they are much more numerous in soils containing excess of organic matter than in a soil of different analysis. Cultivated ground has always been found to be richer in bacterial growth than virgin soil, but whether this be due to the difference in composition or the greater opportunity of contamination has not as yet been satisfactorily proved.

When several samples are taken from a locality, and a large number of localities examined, it will be found that soil bacteria can be divided into two classes:

1. Those that have a wide or general distribution (Tetanus).
2. Those that are local, and have their areas strictly defined (Anthrax).

Thus the numerical strength of the soil bacteria must be something enormous, but we shall consider only those pathogenic, and even this species can be divided into the same two classes. But I shall restrict myself to one or two more common micro-organisms, found locally, which, from their pathogenetic nature, give rise to well-known diseases. In doing so, however, I do not presume to bring forward anything new regarding their morphology, but rather to consider the etiology of the diseases, in the belief that the contagion may have been carried by soil contaminated by an animal suffering from the specific disease, or by the carcass of one which has died from that particular malady.

The soil may be a pabulum in which bacteria grow and multiply, or it may be simply a medium in which organisms obtain their resting stage, and spores are formed which may lie inactive, but retaining their virulency for an indefinite period.

In anthrax, for example, it is known that the bacillus rarely, if ever, forms spores in the body, and if the bacilli could be confined to the blood and tissues of the carcass, serious outbreaks of anthrax would rarely occur. It has also been demonstrated that during the putrefactive process the anthrax bacilli rapidly die out, and that after ten days or a fortnight very few remain. On the other hand, an animal suffering from anthrax disseminates by the discharges from mouth, nose, and anus countless bacilli, which may spore, and thus reach the resting stage, when their resistance is very great indeed. Koch found they resisted boiling for five minutes, and dry heat must be applied for several hours at 140° C. to kill them. In a dry condition they will remain viable for a year or more, while, unlike the bacillus, they can resist the action of gastric juice for a very long period of time.

The spores may germinate, multiply, and grow on the organic matter present in the soil; but if the bacilli thus formed are swallowed they are killed by the gastric juice. But the spores may lie, as spores, in the ground until ingested by an animal. They can then pass uninjured through the stomach, and, gaining

an entrance into the intestine, infect its wall, and ultimately reach, and multiply in, the blood. It is now known that in the majority of cases of the disease in sheep and oxen infection takes place through the intestine, although it is possible bites of insects may afford a means of inoculation.

These possible sources of infection must be carefully guarded against, and all discharges and bedding burned, while the carcass must be disposed of in such a way as to prevent future infection. It was said by Pasteur, and confirmed by Bollinger, that earthworms were agents in the spread of anthrax by bringing to the surface the spores. Koch denied this, but his explanation of the recrudescence of epidemics in fields where anthrax carcasses have been buried is much less feasible than that advanced by Pasteur. Perhaps, if the regulations of the Board of Agriculture as to the burial of carcasses were carried out to the strict letter, the danger of infection might be reduced; but as it is doubtful in many cases if the grave is 6 feet deep, and the quantity of lime used as stipulated, I am strongly of opinion that the carcass should be burned. I admit in an epidemic this entails great labour and expense, but the certainty of the course warrants the expenditure.

It is imperative that no post-mortem examination be made. Indeed, every sudden death is to be considered anthrax until otherwise proved by microscopic examination of a drop of blood from the ear.

A case which occurred recently in the North illustrates the importance of observing this rule. A bullock had died and a post-mortem examination was made to ascertain the cause of death. It proved to be anthrax, and the blood which escaped was washed into a manure stance. The manure was carted to a field and there spread. Samples of the manure and soil taken in the field contained the organism, as was proved by inoculating guinea-pigs, and, notwithstanding the treatment the field received, on my recommendation, some doubt exists in my mind as to the total destruction of the spores.

There is, therefore, abundant evidence that by carelessness and want of technical knowledge in the disposal of such a carcass, or

of the excretions and discharges, the soil may become infected, and to this source, I doubt not, could be traced anthrax in its epidemic form on more than one occasion.

Another pathogenic organism found in the soil of certain localities is the bacillus of symptomatic anthrax or black quarter. This organism differs from that of anthrax by being, during its vegetative stage, actively motile, rounded at its ends, and anaerobic. A contrast of even greater importance is the fact that the bacillus of black quarter forms spores within the body in from twenty to twenty-four hours after death. Dry spores retain their virulence for a very long time, and are tolerably resistant to the action of heat. When subjected to a temperature of 80° C. for one hour, their virulence is not affected, but an exposure to 100° C. for five minutes completely destroys them. They also seem to be somewhat resistant to the action of chemicals, for when exposed to 5 per cent. carbolic acid they retain their pathogenic properties for about ten hours, whereas the vegetative forms are destroyed in from three to five minutes. Corrosive sublimate is more successful, as the spores are killed in two hours by a solution of the strength of 1 in 1000. Stockman found that spores, after lying in soil for two years, were capable of reproducing the disease when inoculated along with acetic acid.

Thus it is manifest that the spores are very resistant, and that they can lie in the soil for a long period of time, inactive but still viable, until they find access to a suitable medium for their growth, when the disease is reproduced.

In an animal suffering from the disease the muscles and cellular tissues at the points affected are saturated with bloody serum, and the abdominal walls and muscles present a green, shading to a dark-blue, colour. In these areas, in the blood-stained transudates of the serous cavities, in the bile, and, after death, in the internal organs, the bacillus can always be detected. It is evident from this that the soil of localities where affected herds are grazing may readily become contaminated from the living animal, and with certainty from the carcasses of sheep dead from the disease. On many hill farms the carcasses are left lying without even the most primitive attempt at disposal, and are soon

attacked by crows or other animals. In this way the fluids, teeming with spores, are allowed to escape, infecting a considerable area of ground. Indeed, it is just a question if the spores are not scattered broadcast in the excrement of these flesh-eating animals. The following year this area, richly manured by decomposing animal matter, produces a crop of luxurious grass, attracting sheep to what must be a hot-bed of contagion. Burning the carcass would be the most effectual, but it is impracticable, and the only alternative is to bury it deeply, using lime or other disinfectant.

The concluding evidence I would bring forward is the many experiments that have recently been carried out in connection with the soil and the typhoid bacillus, notably by Dr. Sidney Martin and Drs. Robertson and Gibson.

Dr. Martin says the bacillus has no resting stage—*i.e.*, it does not form spores—and this is a most important point when we contrast the organism with those known to form spores, as we have seen that spores are much more resistant to external influences than bacilli.

Robertson and Gibson found that the bacillus in soils containing organic matter not only lived, but grew very rapidly, and survived from one summer to another. "The rains of spring and autumn, or the frosts and snows of winter did not kill them."

Dr. Martin, in cultivated soils, found the bacillus alive and retaining its vegetative properties for as long as 456 days. In certain virgin soils the bacillus would not grow, and soon died out, but there was no evidence to show what property in the soil killed the organism.

In the same investigator's hands sterilized soil proved favourable to the growth of the typhoid bacillus, and three other experiments were performed, simply to test the viability of the cholera vibrio, of the diphtheria bacillus, and of the anthrax bacillus in such sterilized soil. It was found that the cholera vibrio was alive and vigorous when last tested, after sixty-eight days; the diphtheria bacillus was obtained in pure cultivation after sixty-six days, and was still pathogenic, as was shown by inoculation

in a guinea-pig; the anthrax bacillus was alive and virulent sixty-six days after inoculation, killing a guinea-pig in twenty-four hours. Dr. Martin does not mean to say that these were the maximum periods, as the experiments were not continued, and only made to compare the viability of the bacteria.

It is thus obvious that bacilli live in soil preferably cultivated, that spores remain viable for an indefinite period, and, as was the case in anthrax and the other organisms, retain their pathogenic properties even in sterilized soil. How important it is, therefore, to take precautions against the contamination of the ground.

The living animal suffering from disease is always a source of danger, but surely, when death takes place, measures based upon scientific knowledge and sanitary principles could be adopted for the disposal of the carcass, so that the danger would be exterminated, and all possibility of future infection removed.

Unless such measures are adopted the organism to which death was due may grow and propagate, may lie dormant yet virulent, may be carried by birds or other animals, or may dry and be blown hither and thither by the wind. It matters not by which or by how many of these ways, but as soon as it finds a suitable host the disease is reproduced.

Such suppressive measures could only be carried out under the supervision of Veterinary Officers of Health.

THE HARBEN LECTURES, 1903.

THE Council have appointed Professor Ferdinand Hüppe, M.D., Professor of Hygiene in the University of Prague, The Harben Lecturer for the year 1903.

The subjects of his Lectures will be:

(*a*) The Etiology of Infectious Diseases from a Natural Science Point of View.

(*b*) Hygiene and the Lessons derived from Sero-therapy.

(*c*) Tuberculosis.

BACTERIOLOGICAL NOTES.

I.

RECENT STUDIES IN MALARIA.

BY

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THE flagellated forms of the malaria parasite were for a long period the subject of much speculation. Through the observations of Opie and of MacCallum on the malaria-like parasites of birds, we now know that they are the male forms of the sexual cells, the flagella breaking off from the main body and entering and fusing with—*i.e.*, fertilizing—a female non-flagellated cell, should this happen to be in the neighbourhood. This phenomenon, however, is but seldom actually witnessed, and an instance of it is described by Moore.* The male and female cells, or gametes, or gametocytes, as they are termed, differ structurally, and can be distinguished from each other, the former, the male, being hyaline, or much less granular than the female cell. Moore states that he had the good fortune to observe both a hyaline and a granular form within the same field, and quite near together. The pigment of the hyaline body was soon in active movement, and suddenly four very active flagella were extruded.† One flagellum soon broke off from the parent cell, and went plunging about in all directions until it happened to come in contact with the granular female cell, the granules of which were arranged in a wreath-like fashion. After several efforts the flagellum entered the female cell, the ring shape of the pigment being at the same time destroyed. The fertilized cell was watched for another twenty to thirty minutes; but, beyond some slight change in shape and in the distribution of the pigment, nothing further happened.

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* *Johns Hopkins Hosp. Bull.*, October, 1902, p. 235.

† The male gamete becomes flagellated only on the blood being withdrawn from the body.

A second flagellum also came in contact with this female cell after fertilization by the first flagellum, but, after many efforts had been made to enter, it wriggled away.

It is only in the æstivo-autumnal, or malignant, malarial fevers that specially differentiated gametes are met with in the blood—the well-known crescentic bodies. In the benign tertian and quartan fevers the gametes are almost indistinguishable from the asexual forms. Goldhorn, however, states* that, in protracted cases of tertian fever, forms of the parasite are met with which differ essentially from the ordinary ones of the asexual cycle. These do not segment like the asexual parasites, are never seen in recent primary affections, and represent male and female gametes. Stained with chromatin dyes, the male gamete is a rather large parasite with wide achromatic zone, in which a mass of unevenly staining chromatin filaments lies.

The body of the parasite takes basic dyes poorly, and its coarse blackish pigment is brought out more distinctly than in any other form. Before it flagellates, which takes place in a moist chamber, its usually quiescent pigment becomes agitated. The female gamete is still larger when fully developed, and contains a small, irregular chromatin mass, situated excentrically, and its pigment is finer than that of the male gamete.

Middleton† gives an interesting account of an outbreak of quartan fever associated with the disturbance of soil, which formerly would undoubtedly have been ascribed to this factor. Navvies (coolies) were employed outside Singapore excavating for a reservoir, and on February 15 these consisted of twenty-two Javanese, among whom no fever existed. On that day ninety-three Punjabis and Oorias from Assam arrived, all of whom, during the three preceding years, had suffered more or less from fever. On March 1 the Javanese began to be severely attacked with fever of a quartan type. To the casual observer it would appear as though this outbreak of malaria, occurring shortly after the disturbance of the soil, was due to the latter. But, in the

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* *Proc. New York Path. Soc.*, vol. ii., October, 1902, No. 5, p. 89.

† *The Malarial Fevers of British Malaya.* Collected Papers. Edited by Hamilton Wright, M.D., vol. i., No. 1, p. 79.

light of the mosquito-malaria theory, the sequence of events is evident and may be stated as follows:

1. That the Punjabis and Oorias went into healthy Kallang with the parasites of quartan fever in their blood.

2. Anopheles and their larvæ were present.

3. The newcomers slept without nets, and near the heretofore uninfected Javanese.

4. The anopheles of the neighbourhood became infected, and then transmitted the fever to the healthy Javanese.

The disturbance of soil was a factor only in so far as it necessitated the introduction of coolies, who, unfortunately, were infected with malarial parasites.

Kala-azar, a fever met with in Assam, and characterized by its intensity and by the cachexia and enlarged spleen which follows it, has been the subject of much controversy as to its ætiology. It was formerly stated to be a manifestation of ankylostomiasis; then that it was ankylostomiasis *plus* malaria, and, more recently, that it was an intense form of malaria, and this is the current opinion. Bentley,* however, has suggested that this disease is a severe form of Malta fever, and has found that the blood-serum of kala-azar patients agglutinates the Malta fever organism. This view has not yet gained acceptance,† and much more research will be needed before it can be said to be either definitely proved or rejected.

II.

BACTERIOLOGY FOR GENERAL PRACTITIONERS AND MEDICAL OFFICERS OF HEALTH.

BY

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"BACILLUS TUBERCULOSIS" (KOCH).—The general practitioner will rarely have occasion to examine for tubercle other than in

* *Ind. Med. Gazette*, September, 1902, p. 337.

† See Rogers and Price, *ibid.*, October, 1902, pp. 377 and 379.

sputum or pus. To find the organism in milk, urine, or purulent matter is a somewhat difficult and tedious process, generally entailing the use of the centrifuge, more especially when examining urine.

Every medical man ought to be able to examine sputum for tubercle, the more so, indeed, as, since the open-air treatment of phthisis has become the recognised method, the beneficial results of this treatment depend to a great extent on the promptness with which the affection is discovered, and also on account of the need for early removal of the infective centre from others.

The *cultivation* of *B. tuberculosis* is tedious and troublesome, and not necessary when a direct result can be obtained for diagnosis by an examination of the sputum. If, however, a cultivation is desired, it is best to use glycerine agar as the culture medium. If incubated on this at 37° C. (98·6° F.) for about ten days, tiny white specks of growth will be found, separate at first from each other, but tending in time to coalesce, until in eight or ten weeks a uniform growth is seen, forming a peculiar "wrinkled skin" appearance. Primary cultures are, however, often difficult to grow on this medium, and may be more certainly obtained on blood-serum, though a much longer time for this is required.

The process for detecting the bacillus in sputum is a simple one, but care should be taken to select a suitable part of it for examination, as otherwise, if only few organisms are present, they may be missed, and several specimens should always be prepared and examined before giving a "negative" opinion.

The sputum should be collected the first thing in the morning, especially in the early stage of the disease, as later on in the day the organisms are frequently absent from the expectoration. It is best collected in a small, wide-mouthed bottle, from which, when required, a little can be poured into a watch-glass, and careful search made for the small yellow, cheesy particles of broken-down lung-tissue which contain the bacilli.

Method.

1. A little from the centre of this particle should be transferred by the sterilized needle to a cover-slip held in the cornet forceps, and carefully spread in a regular, even layer.

2. Dry this film in the air, and fix by passing three times through a smokeless flame.

3. Drop on with the filter funnel as much carbol-fuchsin solution as the slip will hold.

4. *Warm the solution* gently by holding the slip over the flame of a spirit-lamp until it just steams (60° C.), but on no account let it boil. Repeat the warming three or four times, allowing the stain to remain on the slip for five or six minutes in all, and then wash well in water.

5. Wash in absolute alcohol till the stain is well removed, and again in water.

6. Immerse in 20 or 25 per cent. sulphuric acid for a few seconds, and again wash thoroughly in water.

7. Counter-stain with methylene blue solution for ten or fifteen seconds. Wash in water, dry, and mount.

This is known as the modified Ziehl-Neelsen method of staining. The object of using spirit is to exclude the smegma bacillus, which in appearance is very like *B. tuberculosis*. If we are dealing with the former, the spirit decolourizes it—though Moeller has recently thrown doubt on this point—whereas if *B. tuberculosis* is present the spirit has no action on the stain. Similarly, if there is a possibility of the so-called bacillus of syphilis (Lustgarten) being present, it is decolourized by the acid, whilst *B. tuberculosis* when stained strongly resists such decolourizing. We can, therefore, by a process of exclusion, by means of the decolourizing effects of alcohol and acid on organisms morphologically resembling *B. tuberculosis*, arrive at a definite conclusion that we are dealing with tubercle.

The chief object, however, in using acid when examining sputum is to remove the red fuchsin stain from *all other matter on the film except the B. tuberculosis*, such as bits of lung-tissue, pus-cells, and micrococci, the tubercle bacilli alone remaining stained; and, if desired, the preparation may be mounted and examined at this stage, but the contrast stain of methylene blue, which restains all these other objects, is considered to show up the bacilli more definitely, though personally I prefer mounting without the double stain.

The bacilli, if present, are seen with the immersion lens to be slender rods stained a deep red, straight or slightly curved, and, if from sputum, usually have a beaded or dotted appearance. They are somewhat thinner than *B. diphtheriæ*, and more granular. (The dotted appearance is generally absent in specimens obtained from urine.)

If the double-staining process has been used the ground substance of the film will be seen to be stained blue, and various kinds of cocci may be discovered, tetrads, or clumps of four cocci, being frequently observed in tubercular sputum. If it is desired to preserve tubercular sputum, its infectivity should be destroyed by the vapour of formalin, a little of which can be applied on a plug of cotton-wool pressed into the bottle, attached to and in front of the cork.

III.

BACTERIOLOGICAL NOTES FROM FOREIGN JOURNALS.

Zur Kenntniss der Granula der Zellen des Knochnenmarkes, bez. der Leucocyten. Fried Hesse. (*Anat. Anz.* 18; 452-461, 1902.)—This work gave the author the chance of testing Ehrlich's theory of granular leucocytes. The theory, in brief, is that granular leucocytes form an important group of white blood cells. These granular cells are divided according to the granules found in the protoplasmic body. The kind of granule is determined by the use of a definite fixation (heat) and staining process (triple stain). It is axiomatic that the staining process with dry preparations is due to a chemical change. Different granules stain differently owing to their chemical natures, and are recognized as basophile, acidophile, neutrophile, amphophile, forming definite series without transition forms. More than this, certain forms of granules are found to be characteristic of certain animals, and in others another kind is their equivalent. Such are the pseudo-eosinophile granules in the rabbit with the corresponding neutrophile form in man. The author used for his studies dry preparations of bone-marrow from the rabbit, which was treated exactly according to Ehrlich's process. The dry preparations

were fixed either in ether-alcohol or alcohol at 100°, 120°, 140° C., treated with glycerine and aqueous staining solutions of eosin, indulin, aurantia, orange G., with solutions of eosin-indulin-glycerine, Erhlich's triple glycerine mixture, methylene blue or dahlia, or else, after first staining in eosin or aurantia, counter-staining with methylene blue or with triacid. Lastly, Laurent's eosin-methylene blue with anilin oil, xylol differentiation. The following results were obtained from rabbit bone-marrow: (1) Both in similar and different cells and within a single cell there are wide variations in eosinophile and pseudo-eosinophile granules as to size, form, refraction, and number. (2) There is a difference in intensity of staining of the granules within a single cell on the use of a single stain as well as one produced by the use of a mixed stain. (3) In equivalent cells there is frequently a difference of stain of the intergranular protoplasm. (4) Temperature causes reagents to act differently on granules of different cells and those in a single cell.

The author's conclusions are: (1) That Ehrlich's classification of leucocyte granules dependent on colour analysis is undemonstrable. (2) There are not only differences of granule stains according to the reagents and processes used and different kinds of granules within a cell, but transition forms can be found. (3) The dependence of micro-chemical reaction of many granules upon the definite experimental or pathological process to which leucocytes are subject, and upon the changes due to karyokinesis, account for some of the differences. (4) Since, on account of transition forms, it is impossible to make a classification of leucocytes according to differential staining, the conclusion is necessitated that the granular leucocytes are all of one nature, but possess an extraordinary power of repair and adaptability, especially in regard to the granules contained within the cells. (5) Evidence is strongly in favour of the conclusion that these granules are essential structural parts of the cells, and have a far-reaching influence on resorption, assimilation, and secretion.

New and Simple Media for the Differentiation of the Colonies of Typhoid, Colon, and Allied Bacilli. Hiss. (*Journ. Med. Research*, 8; 148, 1902.)—Hiss has shown that it

is possible by a very simple modification of ordinary culture media to differentiate the colonies of the typhoid bacillus and the colon bacillus upon ordinary plates. The media which he uses for this purpose are several in number. All of them, however, contain agar, and they are quite similar to the ordinary nutrient media. For example, the one upon which the largest amount of work has been done is made up of agar, 15 grammes; gelatine, 15 grammes; Liebig's extract, 5 grammes; dextrose, 10 grammes; water, 1,000 c.c. This material, as will be seen, differs from the ordinary nutrient agar in hardly any point, except that the *peptone is omitted.* In the other media which he describes the peptone is in a similar manner always omitted. Using these media for cultivating typhoid and colon bacilli, Hiss finds the two species very readily differentiated. The typhoid bacillus produces a colony considerably smaller than the colon, and it also develops, after proper growth, an abundance of irregular filaments radiating from a central colony, whereas the colon bacillus produces a colony with a uniform outline. This filamentous condition is a very ready means of differentiation of the two types of bacteria.

JAPANESE CATTLE AND THEIR ALLEGED IMMUNITY FROM TUBERCULOSIS.

In reply to certain inquiries on this subject, Professor Katushima, of the Imperial University of Japan, has replied (*a*) that he dare not say native cattle are immune from tuberculosis, but, according to the report of the Slaughter-house Inspectors, none of the indigenous cattle have ever shown any sign of tuberculosis, while the disease is commonly met with among cross-bred cattle, and those imported from Europe and America. (*b*) Native cattle are either housed or grazed; the construction of the stables is simple, so that natural ventilation is fairly going on. The cattle are isolated, the farmer keeping one or two—seldom more—cattle in his yard. In stables it is very rare to keep a large number of cattle, except in dairies, where the stock almost exclusively consists of foreign breeds, or those crossed with them.

CHEMICAL NOTES.

A Method of Separating Butter from Margarine and other Foreign Fats and Oils. C. Deguide. (*Bull. de l'Ass. belge*, 1902, xvi., 333-336.)—This is based upon the fact that butter in milk is in a state of emulsion, and possesses a superficial tension practically equal to that of milk, and that it is therefore possible to readily form emulsions between butter and milk at 37·5° C., whereas margarine similarly shaken with milk rapidly separates again. The apparatus consists of a sieve, with meshes of about 80 μ, suspended in a beaker holding about 1,000 c.c. A litre of separated milk and 10 grammes of butter (not melted) are introduced, the beaker kept in a water-bath at 37·5° C., and its contents gently stirred until they attain the same temperature, when the interior sieve is withdrawn. In the case of butter, almost the whole will have diffused into the exterior vessel, whereas with margarine the substance remains persistently on the surface, and is only broken up with great difficulty by agitation. It is an interesting fact that this emulsification of the butter with the milk takes place at 37·5° C., the body temperature of the animal. Butters having a higher melting-point than this behave more like other fats in this test.

Analyses of Cognac. F. Freyer. (*Zeits. landw. Vers. Wes. Ost.*, 5, 1266-1271; *Chem. Centr.*, 1903, 1, [1], 54.)—The author has examined four genuine raw cognacs, which had been received at the testing station of the "Syndicat des Viticulteurs Charentes." The results are shown in the following table, together with the figures for a two-year-old cognac (kept in cask for four months) distilled from an Italian wine (No. 5):

	1.	2.	3.	4.	5.
	Grammes per Litre.	Grammes per Litre.	Grammes per Litre.	Grammes per Litre.	Grammes per Litre.
Alcohol	538·400	550·000	550·000	529·400	339·600
Extract	0·500	0·170	0·100	0·930	0·630
Acid (as acetic acid)	0·230	0·150	0·120	0·150	0·460
Esters (as ethyl acetate)	0·810	1·920	0·540	0·640	0·640
Furfural	0·020	0·015	0·020	0·006	0·000
Higher alcohols	2·100	2·530	1·980	3·490	2·020
Aldehyde	0·040	0·130	0·025	0·130	0·130
Volume per cent. of alcohol	67·8	69·3	69·3	66·7	42·8

ROTARY DRUMS FOR EVAPORATION APPARATUS (MILK). M. EKENBERG, Stockholm. (*Eng. Pat.*, 23,770, October 30, 1902.)—The drum has double walls and dished or corrugated bottoms, as well as a perforated partition wall concentric with the drum shaft, so that the heating medium introduced through the shaft can circulate over the entire interior surface of the drum. The active metallic surface on which the drying is effected is composed of nickel or a nickel alloy, hardened by pressure so as to resist chemical action and prevent the contamination of the substances under treatment (see also *U.S. Pat.*, 711,719; *Journal of the Society of Chemical Industry*, 1902, 1548).

METHOD OF TREATING AND UTILIZING TOWN REFUSE AS FUEL. W. P. WRIGHTSON, London. (*Eng. Pat.*, 18,800, September 20, 1901.)—The screened ground refuse is mixed with coal-dust, clay, or the like, and sprayed with crude petroleum. If necessary, a solution of alkali silicate, heated to 180° F., is also added. The resulting mixture is moulded and pressed into blocks or briquettes for fuel. The plant, consisting of a grinding machine, mixing hopper, moulding machine, and presses, is connected by a system of elevators and chutes, rendering the process continuous and automatic.

ACTION OF ETHYL ALCOHOL ON MICRO-ORGANISMS. G. WIRGIN. (*Zeits. Hygiene*, 40, 307-359; *Chem. Centr.*, 1903, 1, [1], 50.)—Under certain conditions the presence of 0·1 per cent. of alcohol had a prejudicial influence on the development of the bacteria (saphrophytes and parasites) examined. This injurious influence becomes greater as the amount of alcohol present increases. With some bacteria the presence of 4 per cent. of alcohol caused no great injury; all the kinds examined were able to develop in the presence of 5 per cent. of alcohol, and the greater number even in the presence of 6·5 per cent. *Bacillus pyogenes aureus* and some kinds of *sarcinæ* grew to some extent in the presence of 7·5 per cent. of alcohol. Several kinds of microbes derived from beer and wort developed in the presence of 7 per cent. of alcohol, *B. viscosus* in the presence of 8 per cent., and a yeast in the presence of 8·5 per cent. of alcohol; 10 per cent. of alcohol

stopped the growth of all the micro-organisms examined. The conditions under which the bacteria are brought into contact with the alcohol are of importance. The action is greater when the bacteria are sown in a nutrient medium containing alcohol than when alcohol is added to a growing colony of the bacteria. Alcohol has a greater injurious action on the germination of anthrax spores than on the growth of bacteria. Increase of temperature favours the prejudicial action of the alcohol, but not to the same extent with different kinds of microbes.

The presence of alcohol (5 to 7 per cent.) in wort had a favourable effect on the growth of acetic bacteria; 10 per cent. of alcohol, however, prevented growth. The micro-organisms did not appear to become acclimatized to the alcohol.

GUAIACUM TEST FOR HEATED MILK. N. WENDER. (*Oesterr. Chem. Zeit.*, 1903, vi., 2.)—Various authors have stated (*cf. Analyst*, 1901, xxvi., 292) that, in using guaiacum as a test for heated milk, the wood tincture, and not the resin tincture, must be employed. Nevertheless, both wood and resin tincture yield the blue colour, but only after those tinctures have begun to suffer auto-oxidization by being exposed to light and air for at least eight or ten days. Fresh tinctures give no colour.

ANALYSIS AND COMPOSITION OF LEMON-JUICES. K. FARNSTEINER. (*Zeit. für Untersuch. der Nahr. und Genussmittel*, 1903, vi., 1-22.)—Analyses are given of pure lemon-juices, the results confirming those given by Borntraeger and Spaeth (*Analyst*, 1898, xxiii., 176, and 1901, xxvi., 269). Instead of estimating the total extract by direct weighing, the author prefers the indirect way, by taking the specific gravity, and gives tables for calculating the extract from the latter. The figures so obtained agree with those of the direct method. Fermentation of the juice, besides decreasing the total extract, causes esters to form, this action also taking place in solutions of citric acid containing alcohol. Glycerine was found in both natural and artificial juices.

EXAMINATION OF ALMOND OIL AND ALMOND SWEETMEATS BY THE KREIS TEST. A. CHWOLLES. (*Chem. Zeit.*, 1903, xxvii., 33.) —The raspberry-red (tending to violet) colour which is given by

peach-kernel oil when treated with Kreis' phloroglucinol and nitric acid test (*Analyst,* 1902, xxvii., 330) enables the presence and the proportion of this material to be ascertained in almond oil. A genuine sample of the latter was prepared by means of ether from some Mogador almonds, which contained 50 to 75 per cent. of the bitter variety, and a second was made from pure sweet almonds from Majorca. The former gave a very faint colour with the Kreis test, the latter practically none at all. It is therefore possible to detect 10 per cent. of peach-kernel oil in almond oil, and, by simultaneously testing a mixture of the oils of known composition, to distinguish between a product containing 10 per cent. and one containing 15 per cent. of peach-kernel oil.

The sweetmeat known as "marzipan" is made from 2 parts of moist pounded almonds and 1 part of sugar, so that it should contain 50 per cent. of almond substance, 33·3 per cent. of sugar, and 16·7 per cent. of water. Occasionally a portion of the almond is replaced by peach kernels. To examine it, 200 grammes should be rubbed down with 100 c.c. of 95 per cent. alcohol, squeezed through a cloth, and the residue treated twice more with 100 c.c. of 80 per cent. spirit. The united extracts are brought into a separating funnel, shaken with ether and water, the ethereal solution of the oil filtered, and evaporated on the water-bath. The last traces of oil may be recovered from the cake by drying it and extracting with ether; but extraction of the original sample is more tedious than the process described. The oil is then tested as above indicated.

The reaction has succeeded when applied to a mass of peach kernels and sugar a year old, appearing as at first. It is also given, though somewhat less strongly, by the oil of the "pignole," the seed of the pine which is native in Southern France and Spain.

NOTES ON SOME ESSENTIAL OILS. J. WALTHER. (*Farmaz. J.*, 1902, xli., 751; through *Chem. Zeit. Rep.*, 1902, 344.)—*Oil of Aniseed.*—This material can be valued by its specific gravity, its solidifying point, and its solubility in alcohol. As the anethol-content varies so largely, it would be better to use anethol instead of the oil itself. Paraffin and spermaceti in anethol or oil of

aniseed are very clearly shown by the solubility in alcohol and by the higher melting-point. Stearine may be detected in the solidified oil by its crystalline form, or more conspicuously by shaking the sample with petroleum ether and a solution of copper acetate.

Oil of Bergamot.—A physical examination of this oil is not sufficient. Its value depends on the esters of linalool and geraniol, which, estimated by Köttstorfer's saponification method, should not be less than 32 per cent. in amount in good specimens. The specific gravity of the oil should be 0·880 to 0·886, and its rotatory power $+8°$ to $+20°$. Treated with an equal volume of 90 per cent. alcohol, it should yield a perfectly clear or but faintly turbid solution, which should not be altered in appearance by further additions of spirit. The residue on evaporation should be 6 per cent.

Oil of Lavender.—The esters should be estimated by the same process as is used with oil of bergamot, and should amount to not less than 30 per cent. Terpeneless oils, however, contain less esters, because geraniol esters break up into their components during fractional distillation. French oil of lavender has a specific gravity between 0·883 and 0·895, is soluble in three volumes of 70 per cent. alcohol, and has an opticity of $-3°$ to $-9°$. Essential oils containing phenols give sufficiently good results when examined by Kremers and Schreiner's method. Eugenol, the most important constituent of *Oil of Cloves*, may be estimated by converting it into its difficultly soluble benzoic ester (Thoms).

Oils of Carraway and Mint.—Carvone cannot be determined in these oils by conversion into oxime according to the Kremers and Schreiner process, as a compound between carvoxime and hydroxylamine is liable to be produced. Still, when hydroxylamine hydrochloride is mixed with carvone in some indifferent solvent, treated with sodium bicarbonate, and heated under an inverted condenser on the water-bath, no loss of oxime occurs; the excess of hydroxylamine may then be titrated with sodium hydroxide, thus forming a very simple and exact method of determining carvone. The oxime of the lævo-rotatory carvone in oil of

mint and that of the dextro-rotatory carvone in carraway are identical, melting at 71° C., and being optically inactive. The proportion of carvone in these two oils varies considerably, but in good specimens should be 50 per cent.

Oil of Lemon.—In the valuation of this oil the most important points are the optical activity and behaviour on fractional distillation. A determination of the special aldehydes, citral and citronellal, is not possible; but good results are to be obtained by converting them into oximes, and titrating the excess of hydroxylamine. It is necessary to modify the usual method slightly, for in presence of much hydrochloric acid the oximes are liable to be partly converted into organic acids. For this reason an iodometric titration of the hydroxylamine possesses advantages. The normal proportion of aldehydes in oil of lemon is about 5 per cent.

Oil of Sandalwood.—In this oil the santalol must be determined. Parry's process with Schimmel's modification requires a correction to be made, for on saponifying the products of acetylation, traces of acetic acid are liable to be left. Besides this estimation the physical constants must be ascertained.

Separation of Lead from Manganese by Electrolysis. A. F. Linn. (*Amer. Chem. Journ.*, xxix., 82.)—Having previously found (*Analyst*, xxvii., 229) that lead can be completely separated electrolytically from a solution of its phosphate in phosphoric acid, whilst manganese is not deposited, the author now shows that under certain conditions the method affords a means of separating the two metals. For this purpose the solution containing lead and manganese as nitrates is precipitated with a small excess of sodium hydrogen phosphate; the phosphates are dissolved in excess of phosphoric acid solution (specific gravity 1·70), and the solution electrolysed for about eighteen hours at the ordinary temperature, using a current of N.D. $_{100}$ = 0·005 ampère, and 2·5 volts. The dilution should be about 0·1 gramme of metal in 130 c.c. The deposit of metallic lead is washed, first with air-free water, then with alcohol and ether, and is weighed after being dried at 100° to 110° C. A small amount of hydrated peroxide of manganese is always found on the anode.

THE ROYAL INSTITUTE OF PUBLIC HEALTH.

The following correspondence has taken place with regard to the award of the Harben Medal:

"19, BLOOMSBURY SQUARE, W.C.,
"*January* 22, 1903.

"MY DEAR SIR CHARLES CAMERON,

"I am desired by the Council of the above Royal Institute to inform you that they have unanimously conferred the Harben Medal for 1901 upon you in recognition of your eminent services to the Public Health.

"In making this award the Council have considered your devoted work for many years in the cause of Preventive Medicine, and your indefatigable efforts to promote the development of this important department of Medicine; it is with satisfaction also that the Council recalled the fact that you were one of the founders of The Royal Institute of Public Health, and that you have been closely identified with its work from the first, to the success of which your efforts have in no small measure contributed.

"The Council are also desirous of recognising, and, if possible, encouraging, the work which is being done in Ireland for the amelioration of the insanitary conditions under which the poorer classes live, and they are glad to embrace the opportunity which your services afford for doing so.

"I feel it a great privilege to be the medium by which the decision of the Council is conveyed to you, for perhaps no one connected with The Royal Institute knows so well as myself the value of the services you have at all times placed at our disposal.

"With very sincere wishes that your useful life may long be spared,

"Believe me,
"Yours very sincerely,
"WILLIAM R. SMITH, *President.*"

The following letter has been received in reply:

"*February* 28, 1903.

"DEAR MR. PRESIDENT,

"I have received your kind letter informing me that the Council of The Royal Institute of Public Health have been so good as to award me the Harben Gold Medal for 1901.

"Please convey to the Council my most grateful thanks for the great honour which they have conferred upon me. I appreciate it highly, though I cannot but feel that I have not merited so great a distinction.

"Pray also accept personally my sincere thanks for the kind terms in which you have conveyed to me the award of the Council.

"Believe me,
"Very sincerely yours,
"CHARLES A. CAMERON.

"WILLIAM R. SMITH, ESQ.,
"M.D., D.Sc., F.R.S. Edin.,
"*President.*"

THE following have been elected members of The Institute:

As Fellows:

JAMES BENNETT, M.R.C.S., D.P.H.
MISS ADELA BOSANQUET, L.R.C.P.I., Dip. State Med.
JAMES ARTHUR RINDER GLENNIE, M.B., D.P.H.
Major JAMES WILLES JENNINGS, R.A.M.C.
Lieutenant-Colonel GEORGE FREDERICK ALEXANDER SMYTHE, R.A.M.C.
Lieutenant FRANCIS PETER VIEYRA, I.M.S.
THOMAS WRIGHT, M.B., D.P.H.

A portrait of His Majesty, King Edward VII., Patron, which has been graciously signed by His Majesty, has been hung in the Council room of The Royal Institute.

PUBLIC HEALTH MEDICAL APPOINTMENTS.

THE following appointments have been made:

ADAMS, T. D., M.D., Medical Officer of Health, Yeovil Rural District.
BARBOUR, T. M., M.B., Medical Officer of Health, Ramsey, Isle of Man.
BARCLAY, W. B., L.R.C.P., D.P.H., Medical Officer of Health, Farnborough, Hants.
FLOOK, H., L.R.C.P., Medical Officer of Health, Redhill, Australia.
CROOKS, J., M.D., Medical Officer of Health, Chard.
DALBY, A. W., L.R.C.P., Medical Officer of Health, Frome.
DUNLOP, T., M.B., D.P.H., Medical Officer of Health, Torquay.
FARRAR, R. A., M.D., D.P.H., Medical Inspector, Local Government Board.
FINCH, H. E., M.B., District Health Officer, New Zealand.
FLOWER, F. J., M.R.C.S., Medical Officer of Health, Warminster.
HOBLING, T. H., L.S.A., Medical Officer of Health, Bideford.
JOHNSON, H. S., M.R.C.P., Medical Officer of Health, Totnes.
MORSE, E., L.R.C.P., Medical Officer of Health, Great Torrington.
MURRAY, J., M.B., Medical Officer of Health, Llandrindod.
WILLIS, J. G., L.R.C.P. Edin., Medical Officer of Health, Auckland, Yorks.

THE ROYAL INSTITUTE OF PUBLIC HEALTH.

LIVERPOOL CONGRESS.

July 15 to *July* 21, 1903.

IN UNIVERSITY COLLEGE, LIVERPOOL.

President.

THE RIGHT HON. THE EARL OF DERBY, K.G., G.C.B.

Vice-President and Chairman of the Executive Committee.

THE RIGHT HON. THE LORD MAYOR OF LIVERPOOL.

Vice-Presidents.

The Right Hon. the EARL OF SEFTON.
The Right Rev. the LORD BISHOP OF LIVERPOOL, D.D.
The Right Rev. BISHOP WHITESIDE, D.D.
The CHIEF RABBI.
The Most Rev. the GREEK ARCHIMANDRITE.
The LORD MAYOR OF DUBLIN.
The LORD PROVOST OF EDINBURGH.
The LORD PROVOST OF GLASGOW.
The LORD PROVOST OF ABERDEEN.
The Right Worshipful the MAYOR OF EASTBOURNE.
The Right Worshipful the MAYOR OF BIRKENHEAD.
The Right Worshipful the MAYOR OF CHESTER.
The Right Worshipful the MAYOR OF EXETER.
The Right Worshipful the MAYOR OF ST. HELEN'S.
The Right Worshipful the MAYOR OF WARRINGTON.
The Right Worshipful the MAYOR OF BLACKPOOL.
The Right Worshipful the MAYOR OF BOOTLE.
The CHAIRMAN OF THE LANCASHIRE COUNTY COUNCIL.
The CHAIRMAN OF THE CHESHIRE COUNTY COUNCIL.
The CHAIRMAN OF THE MERSEY DOCKS AND HARBOUR BOARD.
R. P. HOUSTON, Esq., M.P.
Sir ELLIOT LEES, Bart., M.P., D.S.O.
W. F. LAWRENCE, Esq., M.P.
D. MACIVER, Esq., M.P., J.P.
C. MCARTHUR, Esq., M.P., J.P.
T. P. O'CONNOR, Esq., M.P.
W. W. RUTHERFORD, Esq., M.P.
AUSTIN TAYLOR, Esq., M.P.
Sir J. A. WILLOX, M.P.
The PRESIDENT OF THE CONSULS' ASSOCIATION
(The Chilian Consul-General).
The TREASURER OF THE CONSULS' ASSOCIATION
(The Belgian Consul).

The SECRETARY OF THE CONSULS' ASSOCIATION
(The Greek Consul).
Sir W. M. BANKS.
Sir THOMAS HUGHES, J.P.
Sir EDWARD RUSSELL.
Principal DALE, M.A.
J. CAMERON, Esq., M.D.
W. CARTER, Esq., M.D.
R. CATON, Esq., M.D.
ALFRED HOLT, Esq.

SECTIONS.

A. PREVENTIVE MEDICINE AND VITAL STATISTICS.

Hon. Secretaries: A. A. MUSSEN, Esq., M.D.
H. S. WILSON, Esq., M.A., M.B.

B. BACTERIOLOGY AND COMPARATIVE PATHOLOGY.

Hon. Secretaries: R. T. HEWLETT, M.D.
H. E. ANNETT, Esq., M.D.

C. TROPICAL SANITATION.

Hon. Secretaries: James CANTLIE, M.A., M.B.
T. W. W. STEPHENS, M.A., M.D.

D. CHILD STUDY AND SCHOOL HEALTH.

Hon. Secretary: J. HAY, M.B.

E. PORT SANITARY ADMINISTRATION.

Hon. Secretaries: J. WRIGHT MASON, M.B.
W. HANNA, M.B.

F. SANITATION OF CONGESTED AREAS AND REHOUSING THE DISPOSSESSED.

Hon. Secretary: F. F. TURTON, Esq.

G. MUNICIPAL AND PARLIAMENTARY.

Hon. Secretary: E. W. PIERCE, Deputy Town Clerk, Liverpool.

H. ENGINEERING.

Hon. Secretary: J. BRODIE, City Engineer, Liverpool.

DIPLOMAS IN PUBLIC HEALTH.

Diplomas in Public Health have been granted by the Royal College of Surgeons of England in conjunction with the Royal College of Physicians, London, to the following gentlemen: B. L. T. Barnett, M.B., B.C. Camb.; H. J. Barratt, L.R.C.P.; T. Bell, L.R.C.P.; J. Bennett, L.R.C.P.; E. C. Bousfield, L.R.C.P.; E. H. Brown, M.D., M.R.C.P.; R. F. Clark, L.R.C.P.; A. G. Davidson, M.D.; A. B. Dunne, M.B.; E. G. Hill, L.R.C.P.; G. P. W. James, L.R.C.P.; W. C. Lodwidge, L.R.C.P.; T. S. Logan, L.R.C.P. Edin.; L. Milburn, L.R.C.P.; D. J. Morgan, M.B.; W. Murray, M.B.; W. J. Shannon, M.B.; J. M. Petrie, M.B.

REVIEW.

Colonial and Camp Sanitation. By G. V. POORE, M.D., F.R.C.P. Longmans, Green and Co. Price 2s. net.

This little volume contains in a condensed form matter of general interest to the sanitarian who may at any time be called upon to lay down the correct principles of sanitation for the needs of persons living in remote places.

Dr. Poore's support of the Trench system of disposing of fæcal matter is particularly valuable, and should be regarded by sanitarians in tropical climates, where the need of simple methods of sanitation is great and where land is plentiful.

BOOKS, JOURNALS, REPORTS, ETC., RECEIVED.

THE Council desire to acknowledge with thanks the receipt of the following book:

From Longmans, Green and Co.:

"Colonial and Camp Sanitation," by G. V. Poore, Esq., F.R.C.P.

And the following:

The Lancet; The British Medical Journal; The Sanitary Record; The Surveyor; The Medical Times and Hospital Gazette; The Pharmaceutical Journal; The Councillor and Guardian; Albany Medical Annals; Glasgow Medical Journal; Public Health; The Journal of Applied Microscopy; The Journal of the Society of Chemical Industry; Egésyég; La Salute Pubblica; Journal of Tropical Medicine; Journal of Balneology and Climatology.

Annual Reports: Borough of Paisley, Brentwood Urban District Council, Borough of Pudsey, Goole Urban District Council, Doncaster Rural District Council, Buckingham Rural District Council.

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Communications respecting Editorial matters should be addressed to "THE EDITOR, JOURNAL OF STATE MEDICINE, 19, Bloomsbury Square, W.C." *Those concerning business matters, non-delivery of the* JOURNAL, *etc., should be addressed to* "THE SECRETARY, The Royal Institute of Public Health, 19, Bloomsbury Square, W.C."

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Telephone number of The Royal Institute of Public Health, No. 1614 Central.

The Journal of State Medicine.

THE OFFICIAL ORGAN OF
THE ROYAL INSTITUTE OF PUBLIC HEALTH.

VOL. XI.] MAY, 1903. [No. 5.

A FEW FACTS CONCERNING REFUSE DESTRUCTORS.

BY

W. FRANCIS GOODRICH,
Of London.

(*Continued from page* 202.)

WE have had ample evidence for some few years past now, in connection with some of the best modern high-temperature destructors in this country, that the percentage of incombustible varies in different districts and at certain seasons from 25 per cent. to 30 per cent. of the original. The residuum has been analyzed, and has been found to be practically devoid of any trace of calorific matter. So much for the possibilities of further reduction.

Some clinker analyzed at Nelson early last year gave the following result :

	Per Cent.
Silica	40·6
Lime	11·2
Alumina	18·5
Ferric oxide	22·8
Magnesia, manganese, and alkali	6·9
	100·0

This may be said to be a fair average sample of vitreous clinker, and it is difficult to see how material composed of such ingredients can be reduced to any extent. I think it will be

equally difficult to adduce any logical reason as to why it should be necessary to further reduce the same even if it were possible.

As to the remarkably high temperature, I have only to say, Is it entirely new? Is it worth reaching? What will it cost to reach and maintain it? And seeing that the best authorities are agreed that a temperature of 1,400° F. is sufficiently high to effectually destroy all organic matter and avoid nuisance, then why in the name of common-sense is 3,000° F. required?

Someone may say, What do you want 2,000° F. for? My answer is, So that there may be a reasonable margin above the safety point of 1,400 F.; 600° margin is useful, or may I say advisable, so as to allow for fluctuations in temperature which must occur in average work. For instance, during clinkering the temperature as a whole suffers, and a reasonable margin of safety is therefore to be insisted upon, especially in isolated cell-systems. Again, if we look at the destructor from its secondary point of view, as a power-producer, then, if steady steaming is required, you must have a steadily maintained high temperature; the less the fluctuation the better for the production of power.

It has often and rightly been urged that the primary duty of a destructor is to rapidly and effectually destroy refuse—*i.e.*, to cremate without nuisance the most offensive forms of waste and filth of every kind; this is now being done satisfactorily all over this country, as is well known. If offensive market refuse, large quantities of fish offal, and even carcasses, can be disposed of without nuisance, then I submit that we have reached a very satisfactory position, and it is unnecessary to reach or maintain a temperature sufficiently high to fuse wrought iron; again, the medical profession have not decreed that this is a substance which must go to the destructor and show unmistakable signs of being the better or worse for it.

I have some curios here which have accidentally been fed into the small destructor at Aldershot Urban District Council's Sewage Works; both wrought iron and steel show clear signs of fusion. But this is only everyday work, there is nothing new or strange about it; such specimens may be found frequently, and are not the result of any special effort. At the same time, I must say

that we do not specially cater for fusing metals, but the fact that it does happen simply goes to show that we do reach very high temperatures, I may say unnecessarily high temperatures, so far as the destruction of harmful substances goes.

The steam boiler is a very necessary adjunct to the modern destructor, and with the evolution of the destructor there have been great changes in the boilers used. As will doubtless be known, multitubular boilers were employed with the early destructors, but as the fuel value of refuse became recognised, this old type of boiler, steaming at 50 lb. to 60 lb. pressure, ceased to be used, giving way to modern high-pressure boilers both of the Lancashire and water-tube types, steaming up to 200 lb. pressure.

It is only three years next month since steam at a pressure of 200 lb. to the square inch was produced for the first time at Darwen, Lancashire boilers being used.

The water-tube boiler has done excellent work, and is in use with a large number of destructors; it is a rapid steam raiser, but also loses steam very quickly, owing to the limited steam and water space.

I do not hold a brief for any particular type of boiler, but I was greatly astonished recently to read in a letter sent to the *Engineer* of April 11, and signed by Mr. Frank Leslie Watson, the following remark: "It is not possible to obtain its full rated capacity from a Lancashire boiler with destructor gases." Now, if this is correct and borne out by actual practice, then obviously one of the most useful boilers on the market has but a poor future for use in connection with power destructors, but it can be clearly shown that Mr. Watson is wrong; the Lancashire boiler fired with destructor gases can be worked far beyond its rated capacity for coal-firing.

Let us take one timely example. At your Eastbourne Congress last year, Mr. Priestley, of Nelson, presented you with some remarkable figures. In one test with a four-grate unit Meldrum destructor, working in connection with a Lancashire boiler 30 feet long by 8 feet in diameter, the average hourly evaporation from the boiler was actually 1,344 gallons, and the maximum for one

hour during the test 1,646 gallons, a result never yet reached even under forced conditions with the finest Welsh coal since Lancashire boilers were first made.

Yet another example. With a similar plant, at Lancaster, during a twelve-hour test made in February of the present year, one Lancashire boiler, 30 feet by 8 feet, steaming at 200 lb. pressure, evaporated 982 gallons per hour.

Now, what is the rated capacity of a Lancashire boiler fired with good coal, and working under favourable conditions? Actually 780 gallons per hour only.

It is necessary that this mistaken notion should be dispelled. The Lancashire boiler has many features which render it a most useful boiler for combining with a destructor, not the least of which is its extreme simplicity and accessibility for easy cleaning; its record in connection with destructor work is an excellent one, and those who would hold this boiler responsible for any shortcomings will find the real explanation elsewhere.

In many cases—for instance, at small sewage works—there could be no more useful boiler than the Cornish type; it is already extensively used, and is likely to be largely adopted. The water-tube boiler has its advantages, and it has been largely adopted, but it would be a fatal mistake to suppose that this is the one and the only type of boiler eminently suitable for use in connection with destructors.

Each case has to be considered on its merits. All three types of boilers named have proved to be exceedingly useful for steam raising with destructor gases; but for steady steaming with a large reserve of steam and water, the Lancashire boiler must always possess undoubted advantages over those of the water-tube type.

In order to arrive at some degree of accuracy as to the comparative value of Lancashire and water-tube boilers in connection with destructors, I have taken the figures of tests made in eight Lancashire towns, four with Lancashire boilers and four with water-tube boilers. On a basis of 20 lb. of steam per indicated horse-power, the average output of the Lancashire boilers is 186·6 indicated horse-power per ton of refuse, against an average

Comparative Results from Six Distinct Types of Destructors in Eleven Lancashire Towns.

	Town.	Evaporation per lb. of Refuse.	Average Steam Pressure.	Temperature of Feed-Water.	Consumption of Refuse per Cell per 24 Hours.		I.H.P. produced per Ton of Refuse on a Basis of 20 lb. of Steam per I.H.P.	Duration of Test.	No. of Cells in Use.	Rate of Combustion per sq. ft. of Grate per Hour.	Boilers in Use.	Test conducted by
			lb.	Deg. F.						lb.		
A	Oldham	·880	128	212	1 Cell	- 7·96 tons	98	24 hours	10 Cells	25	2 Lancs 30 ft. × 8 ft.	Lord Kelvin
A	Ashton-under-Lyne	·783	122	212	1 ,,	- 9 97 ,,	87	24 ,,	6 ,,	31	2 Multitubular	W. H. Vincent, Esq., Elec. Eng.
B	Bury	·532	—	53	1 ,,	- 9 ,,	59·584	4 ,,	6 ,,	33·6	3 ,,	— Watson, Esq.
						t. c. q. lb.						
C	Rochdale	1·78	114	212	4 Grates	- 50 15 1 4	199	6½ ,,	4 Grates	54·9	1 Lancs 30 ft. × 8 ft.	F. W. Brookman, Health Supt.
C	Darwen	1·55	192	212	4 ,,	- 52 2 1 6	173·6	48 ,,	4 ,,	56	1 ,, ,,	R. W. Smith, Saville, Boro' Eng.
C1	Nelson	1·516	118	212	4 ,,	- 61 0 0 0	169·792	9½ ,,	4 ,,	57	1 ,, ,,	J. A. Priestley, Health Supt.
C2	Nelson	1·85	120	212	4 ,,	- 31 0 0 0	207·2	1 mth. continuous	4 ,,	29	1 ,, ,,	Ditto
C3	Nelson	1·95	122	212	4 ,,	- 73 4 0 0	218·4	8 hours	4 ,,	68·5	1 ,, ,,	Ditto
C	Blackburn	1·39	90·8	212	2 ,,	- 25 9 1 12	155·68	12 ,,	2 ,,	48	1 ,, 24 ft. × 7 ft.	W. Stubbs, A.M.I.C.E., Boro' Eng.
D	Fleetwood	1·19	135	212	1 Cell	- 21 11 2 2	133·28	8 ,,	2 Cells	80·5	1 Babcock	Messrs. Medhurst & Lloyd
D	St. Helens	1·54	127	212	1 ,,	- 27 12 0 8	172·48	7 hrs. 20 m.	2 ,,	103	1 ,,	J. S. Highfield, Elec. Eng.
D	Warrington	1·14	68	104	1 ,,	- 23 0 0 0	127	24 hours	2 ,,	88·48	1 ,,	Geo. Darley.
E	Blackburn	1·297	122·3	212	1 ,,	- 11 3 0 12	145·264	7 hrs. 40 m.	4 ,,	34·66	2 Heenan Patent Water-Tube	W. Stubbs, A.M.I.C.E., Boro' Eng.
F	Liverpool	1·173	—	212	1 ,,	- 16 10 0 0	131·376	24 hours	8 ,,	62·16	4 Babcock	

The letters A to F indicate six different types of destructors working in eleven well-known Lancashire towns.

of 143·8 indicated horse-power per ton of refuse with water-tube boilers.

My reason for choosing Lancashire towns is because there is a distinct similarity in the refuse of the places chosen, which are all manufacturing towns situated in coalfield areas.

If we are to make any useful comparison between boilers of various types, or even destructors of various types, it is obviously necessary to choose a number of installations situated in towns similar in character, and all within a limited area.

It is for this reason again that, in giving some tabulated figures of tests with destructors, I have chosen eleven Lancashire towns with six different types of destructors.

It will be observed that there is a wide difference in the results obtained; but, as I am anxious to avoid invidious comparisons, I have refrained from mentioning the type of destructor in use, each distinct type of destructor being indicated by a letter.

Taking the distinguishing letter, it will be noticed that where one type of destructor is in use in three or four different towns, the results obtained are, nevertheless, very uniform, and this serves to prove conclusively that, with refuse uniform in composition, the wide difference in results obtained in Lancashire towns may be fairly attributed to the difference in design and efficiency of the destructor in use.

Coincident with the evolution of the refuse destructor there has been a remarkable improvement in the vehicles used for the collection and delivery of the refuse. There can be no doubt that to a considerable extent the adoption of modern power destructors has been the means of bringing about this very necessary improvement. On several occasions, when giving evidence at Local Government Board inquiries concerning refuse destructors, I have heard Medical Officers of Health and ratepayers who have favoured the installation of the destructor express very decided opinions as to the necessity of employing modern covered vans for collection.

It is, indeed, a healthy and remarkable sign of progress, and no mean tribute to the modern destructor, when the man in the

street is satisfied that the actual process of destruction will be free from nuisance, but that the only nuisance will in all probability arise in the street by the employment of obsolete vehicles for collection.

During the past few years modern covered vans have been extensively adopted, but much yet remains to be done all over the country to bring the collection process into line with present-day requirements. Whether the refuse is destroyed or not, there are obvious advantages in keeping it as dry as possible; therefore covered vans are a real necessity. Again, in windy weather a great nuisance results from the use of open vehicles and the consequent escape of dust, and those who protest, and rightly too, at the escape of dust from the chimney-top of a refuse destructor would do well to bear in mind that it is possible "to strain at a gnat and swallow a camel."

Medical men agree generally as to the disease-spreading properties of dust, and I would observe that the dust liberated from freshly collected, but possibly stale, refuse cannot be compared with the dust which may escape from a destructor chimney. The latter, although admittedly very objectionable, may be said to be free from germs, providing, of course, that the destructor in use is a modern one, while the former is not only highly objectionable, but dangerous.

It is pleasing to observe that Medical Officers of Health all over the country constantly urge the adoption of modern covered vans, and as the question of collection is so very closely allied to that of disposal, I thought it would be of interest to briefly refer to a few of the latest types of collection-vans, both for horse haulage and also self-propelled vehicles.

Among the best of refuse collection-vans for horse haulage is that known as the "Champion," made by Messrs. Wm. Glover and Sons, Ltd., of Warwick. This van was awarded the London County Council premium, and seems to be thoroughly well designed for its work. It is fitted with patent wind-guards, having for their object the prevention of dust escaping while the van is being filled. Another good feature is the provision of sliding covers, each working in a separate groove. These vans

have been largely adopted in various parts of the country, and thirty have recently been ordered for the city of Westminster.

Another excellent covered tipping-van is that made by Messrs. Geo. Rowe and Sons, of Lower Edmonton. A special feature of this van is the very expeditious tipping arrangement, the tail-board opening automatically upwards as the van is tipped. These vans are fitted with either a top central rail for carrying a tarpaulin covering sheet, or they can be fitted with either wooden or galvanized fixed covers if desired. Vans of this type have recently been adopted by the Borough Councils of Wandsworth and Fulham.

Among steam motor vehicles for refuse collection may be mentioned those made by Messrs. Simpson and Bibby, of Manchester. A special type of tubulous steam generator is provided; the engine is of the single-acting enclosed type and exceedingly simple; superheated steam is used. The fuel usually employed is coke, but coal or petroleum with an oil-burner can be substituted if preferred.

The makers are supplying one of their motor-vans to the Wellingborough Urban District Council, and it is interesting to note that, as the collection of refuse will usually be completed by mid-day, the van will be used to convey coal to the waterworks, and also road-making materials to various parts of the town as required.

Another excellent motor-van, well designed and nicely finished, is that made by the Thornycroft Steam Waggon Company, Ltd., of Chiswick and Basingstoke. This company have supplied a large number of motor-vans or waggons to municipal authorities, and their vehicles are perhaps especially interesting because of their easy adaptability for various kinds of municipal work; for instance, the Thornycroft municipal waggon for road watering and washing, with a tank body to contain 700 gallons of water, is readily convertible into a tipping refuse collection waggon, having a capacity of seven cubic yards. So far as I am aware, this very convenient interchangeability is not yet found with any horsed vehicle.

The same waggon already alluded to may be obtained, if so

desired, fitted with a power-driven road-sweeper, a further example of useful adaptability; a vehicle of this type is already in use by the Borough of Kensington, and a second one is just now on order. Similar vans are now used by the Corporation of London, the City of Westminster, and the Boroughs of Chelsea and Hampstead, and those of us who have seen these in busy London thoroughfares will know that they do their work well, travelling quietly and without emitting smoke from the chimney.

Careful experiments have shown that the motor is economical, and there can be no doubt that they will be largely adopted for municipal purposes in the future, the progress that has been made already being very satisfactory.

In years gone by, and even at the present time in many places, any antiquated vehicle is considered good enough for carrying refuse; the work of collection has been most unsatisfactorily done, and, as a general rule, it may be said that the work is not satisfactory until it is done by the Sanitary Authority. I will go further and say that in a town where a modern destructor is in use, and where power is expected from the plant, the refuse is collected more thoroughly, regularly, and systematically—in short, it is really wanted where it has a recognised fuel value; but no one, I think, would suggest that the contractor is similarly anxious to secure every ton of refuse to cart to the refuse-tip.

The removal of refuse should be carried out on systematic lines: it should be commenced as early in the morning as convenient, and carried through expeditiously; the vans should be so constructed that no possible nuisance can result either from escaping dust or smell; and, lastly, the vehicles should be periodically and thoroughly cleansed.

For smart systematic collection of refuse the record of Shanghai, China, would be difficult to improve upon. Mr. Chas. Mayne, the municipal engineer of this populous city in the Far East, recently told me that the whole of their refuse is collected and on the river ready for removal every morning before 11 a.m.

Of course, the collection hours must be largely determined by the habits of the people, but this is surely a record for a large city in any country.

There are special and obvious reasons, into which I need not enter, why the refuse of hospitals, infirmaries, asylums, and such public institutions should be finally disposed of on the premises.

It is an unsavoury subject, but one, perhaps, which has received greater attention in America than in this country. At the same time, with some knowledge of this particular class of work, I must say that we are progressing, and what we have done so far in the installation of small, high-temperature hospital destructors has been eminently satisfactory, and is in advance of American practice so far as design and efficient work is concerned.

It is now possible to erect small but powerful high-temperature destructors in connection with hospitals, enabling the whole of the waste, both domestic and highly offensive and dangerous, to be destroyed practically as produced.

I have had experience of such destructors erected at the Northern and Western Hospitals under the Metropolitan Asylums Board, in London, where old, low-temperature destructors were previously in use. The medical staff greatly appreciate the modern destructor, mainly because it does its work expeditiously and without any nuisance.

Photographs of both the old and modern hospital refuse destructors are here, and may be inspected by those interested.

As the actual labour cost involved in destroying refuse is an important item, and as many exaggerated claims have been made as to the great advantages of some types of destructors over others in the matter of reduced labour cost, it will be of advantage to briefly look into the matter.

With this object in view, I have carefully analyzed and tabulated figures taken from two recent and very comprehensive reports on destructors, issued by Mr. W. F. Loveday, the borough surveyor of Stoke Newington, London, and Mr. John Cook, late

borough surveyor of Lancaster, now the city engineer of Capetown. I herewith give the figures, which I hope may be of service.

Taking sixty-one towns in England and Wales, and six different types of destructors, I find that the average cost per ton of refuse destroyed for labour only works out at just a fraction over 1s. per ton.

Taking the five principal destructors in use, I find that the cost per ton destroyed for labour only varies between 1s. 0·125d. per ton, and 1s. 3·92d. per ton.

It would, of course, be more useful if I mentioned the names of the five and their average, but I am anxious to avoid any invidious comparison.

Striking an average of six towns where the refuse is mechanically charged, I find that the average cost per ton of refuse destroyed for labour only works out at 1s. 8·75d. per ton. This is very remarkable, having in mind that labour-saving appliances are in use, but the figures are quite correct, and may easily be verified.

Looking into the figures of thirteen installations in London and the suburbs, with four types of destructors, I find that the average cost per ton burned for labour only works out at 1s. 6d. per ton.

To the close student of the subject these figures will not come as a surprise. I will go so far as to say that if six different types of destructors could be erected in one large city, working under similar conditions, and with a uniform rate of wages all round, that the cost per ton burned would vary very little indeed over the six.

Grossly exaggerated claims have been made in the matter of low labour cost for destruction, but actual practice all over the country only serves to conclusively show that one man can only handle so many tons in his shift of so many hours, no matter what type the destructor may be; but, of course, the rate of wages varies from 4½d. to 7½d. per hour, thus vitally affecting the labour cost. The destructor obviously cannot take any credit for cheap labour, as the same favourable conditions would equally

apply to any other type of destructor which might have been chosen.

The real value of the residuum to any community is, in the main, determined by two factors: Firstly, whether the clinker is vitreous or of the soft and objectionable variety; and, secondly, by local circumstances. To take some cases in point. At Sudbury, in Suffolk, where a sewage scheme is just now being carried out with the bacterial system of treatment, it was found some months ago that a supply of clinker could not be obtained delivered in trucks at the station for less than 17s. 6d. per ton, and even then the quality would not be equal to vitreous destructor clinker. I have another case in mind in London where the clinker is so very soft and useless that each ton actually costs 2s. 6d. to be got rid of. In yet another part of London —the suburb of Tooting—a good vitreous clinker sells freely at 1s. 9d. per cubic yard at the destructor works.

On the whole, I am inclined to think that if the clinker is really good, it can be got rid of even in the most awkwardly situated localities, if not at a profit, at least without any loss; but all clinker is not good clinker. To produce a thoroughly serviceable clinker high-temperature working is essential, and the fires must not be rushed, but worked with regularity, allowing reasonable time for thorough burning through.

Clinker certainly seems to answer remarkably well in connection with bacteria beds at sewage works, and there is undoubtedly a big future for the utilization of clinker in that direction. It must be interesting to the intelligent citizen to know that one class of civic waste, after having been rendered harmless, is of so much service in dealing with the other class of waste.

(*To be continued.*)

TYPHOID FEVER IN RELATION TO WATER-SUPPLY.

BY

T. CAINK, A.M.Inst.C.E.,
City Engineer, Worcester.

It has been said that the typhoid case-rate of any town is a fair index of the hygienic quality of its water-supply. Whether that statement expresses a general truth is one of the most serious questions that can engage the consideration of those authorities which are charged with the health of the public. If the answer prove to be in the affirmative, there will rest upon the water authorities of those towns which suffer from a high typhoid case-rate the responsibility of effecting such changes in the source from whence the water supplied is derived, or in the treatment of it before distribution, as shall prevent it from being any longer a vehicle of disease-germs to the consumer.

If such a responsibility follows from the acceptance of the proposition, it is a proposition to which it is scarcely likely assent will readily be given. The matter, however, is of sufficient importance to the public to demand that any facts bearing upon it should be fully and fairly faced.

My experience and investigations have convinced me that the proposition does express a general truth. It does not, however, necessarily imply that water is the only vehicle transmitting the organisms which give rise to typhoid fever, but it does imply that the number of cases of typhoid proceeding from all other causes is small compared with that for which the water-supply, whether it be from public mains or private sources, is responsible.

If, as appears to be sufficiently established, typhoid germs may be conveyed by media other than water, then it is probable that in towns of considerable size a small number of cases will annually occur, even though the water supplied to the inhabitants be hygienically pure.

It may be difficult, but I think not impossible, by a careful consideration of the incidence of typhoid of the various towns throughout the country to determine approximately the average case-rate which may be expected from all causes other than the public water-supply.

My observations, however, incline me to except from this statement towns in which the common privy system still prevails. The retention of typhoid excreta within the vicinity of dwellings, the emptying of the pits, and the possible deposit of the contents upon land in the neighbourhood, create conditions likely to spread typhoid germs, and explain isolated instances of high typhoid case-rates in towns where the evidence is sufficient to negative the assumption that the disease is conveyed by the drinking water.

In submitting the facts which have produced in my mind the conviction that, generally speaking, the typhoid case-rate is an approximate index of the hygienic purity of the water-supply (by which is meant, not its freedom from organic pollution, nor the fewness of its contained organisms, but its inability to injuriously affect the health of the consumer), I ask to be pardoned for commencing my remarks by relating, at much greater length than is agreeable to one professionally identified with them, the circumstances connected with a particular case. Such observations may be of service to other towns similarly situated with respect to their water-supply; moreover, it is from the case mentioned that I have been tempted to extend my inquiries, with the view of drawing therefrom general conclusions.

For some years prior to 1894 the city of Worcester suffered from a much greater number of typhoid cases and deaths annually than the average of similar towns throughout the country.

The city has derived its water-supply from the river Severn, in one way or another, from time immemorial. The Severn has also served as the conduit for the drainage of towns and villages along its banks for periods equally remote. Until about the year 1899 the town of Shrewsbury discharged the whole of its sewage in a crude state into the river; while the Stour, which is still considerably polluted with sewage and manufacturers' waste liquids,

discharges its water into the Severn some sixteen miles above the Worcester Waterworks' intake, Shrewsbury being situated much higher up the stream. The last-mentioned town has now established sewage purification works, so that the purified effluent only now enters the river.

In 1857 waterworks were built by the City Council to the designs of Mr. Thomas Hawksley, Past President Inst.C.E. These works consisted of a pumping-station, subsiding tanks, filter-beds, and a service reservoir. These were extended in 1867, no further extension being made until 1894, notwithstanding that the city had greatly increased its population.

For a number of years prior to 1894 the numerous typhoid cases occurring annually in the city engaged the anxious attention of the Corporation.

The analyst's reports of the water varied from time to time within very wide limits. Sometimes the filtered water was pronounced excellent, with an albuminoid ammonia figure of 0·003 per 100,000; at other times it was declared unfit for use, the albuminoid ammonia exceeding 0·01 per 100,000. All the opinions expressed until very recent years were, of course, founded upon the *chemical* examination of the water.

The question of abandoning the river Severn as a source of supply was for many months seriously discussed by the City Council, with a proposal to obtain a fresh supply from artesian wells sunk in the new red sandstone, which crops out favourably in the district of the Lickey Hills, about fourteen miles from the city.

The Council was sharply divided upon the subject. There were those who believed that the city water had nothing whatever to do with the typhoid; others were convinced that the water was responsible for it, and that nothing short of a new supply from a purer source would avail to check it; while a third section argued that, if the typhoid was communicated from the water, improvement in the filtering arrangements might remedy the evil.

Many of the most eminent experts were consulted—engineers, chemists, and geologists. There was a general agreement among

the chemists that if they were advising on the establishment of new works there would be no hesitation in recommending the Council to go farther afield and obtain a supply from the new red sandstone, rather than take water for a public supply from the Severn.

In consideration of the cost, however, they were not in agreement as to the desirability of abandoning the present waterworks for the purpose of securing water from artesian wells. The Council, after experimenting with Anderson's iron purification process, finally decided to make the best of the works they already possessed, and to materially increase the area of the filter-beds. No other works for improving the quality of the water were adopted beyond certain arrangements for indicating at a glance the rate of filtration in each of the beds and placing it under complete control, a feature to which I attach the greatest importance.

The works were completed in the spring of 1894. Several months elapsed before the beds attained a condition producing a perfectly satisfactory filtrate. In June of the following year, in a report to the Water Committee upon the results of the extension of the filtering area, I made the following observation:

"There is probably not on record a more striking instance of the beneficial effect of an improvement in a public water-supply than in the extraordinary reduction in the cases of typhoid in the city, which has followed the extensions referred to. The number of cases which for the winter half of the four years ended March, 1894, averaged fifty-two, fell in the corresponding half-year, ending March, 1895, to six."

The average typhoid case-rate had been, so far as can be ascertained, down to 1894 about 150 per 100,000 per annum. From the beginning of 1895 till the end of 1901 the average case-rate has been thirty-seven.

Certain questions which had so frequently engaged the considerations of the City Council were settled by these results: (1) That the public water-supply had been responsible for the typhoid; (2) that efficient filtration through sand was an effectual

remedy; and (3) that there was no need to look elsewhere for a wholesome supply of water.

It was a matter of common observation that typhoid usually prevailed most during the autumn and winter quarters of the year. It was also well known that the raw river-water was usually more turbid, and the analyst's reports less favourable during those periods, especially after sudden rises of the river. I therefore sought to ascertain whether there was any connection between the typhoid incidence and the variations in the flow of the river. Daily records of the level of the river had been kept in my department for a number of years; a diagram was accordingly devised to show the daily variations of the height of the river, and upon it the weekly number of typhoid cases which had occurred. A consideration of this diagram left no doubt in my mind that a distinct relation existed between the rise of the river and the typhoid incidence. It was seen that after the autumnal rise of the river in September, 1892, the number of cases mounted up with great rapidity, and continued more or less until March, 1893, falling after a fall in the river, and again rising after a swell. A similar phenomenon, though less marked, was seen in the autumn of 1893. It is interesting, however, to note that floods occurring in the spring, presumably after the lands have been washed by the autumn rains, do not appear to bring with them corresponding increase of typhoid fever.

After the completion and maturing of the filters which were added in 1894, the relation between the rise and fall of the river and the typhoid, with perhaps the single exception of the last quarter of 1899, completely disappears. This fact answered a question of great importance to the Council—viz., Was it necessary to construct large storage reservoirs, the cost of which would amount to about £20,000, in order to avoid taking water from the river during the first week or so of flood?

The answer was "No," because during the period of the year when floods and typhoid most prevailed the typhoid cases had, since the enlargement of the filters, been almost invariably fewer than in times of low water in the river.

These circumstances convinced me that incomparably superior

hygienic results can be secured for a given expenditure by sand-filtration alone than by the construction of reservoirs, whether for the purpose of subsidence, or to avoid taking water from the river when in flood. The total capacity of the subsidence reservoirs at Worcester Waterworks is less than one day's upply.

After the great reduction of enteric fever following the extension of the filters, I desired to compare the typhoid incidence in Worcester with that of some other towns, particularly those deriving their water-supply from deep wells in the new red sandstone formation, as that source of supply was the one recommended by some of the experts consulted by the City Council. I accordingly selected eight other towns which appeared typical of their respective kinds—viz., Birkenhead and Wolverhampton examples of new red sandstone water-supplies, Southampton of chalk wells, Liverpool, Manchester, and Plymouth instances of towns which obtain their water from upland sources, and London and Reading from rivers.

The results were somewhat startling. The average case-rate over the ten years ending 1901 of the three towns deriving their water from deep wells regarded as unimpeachable was 149 per 100,000, while of the three towns supplied with filtered river water the cases averaged 77, and of the three towns supplied from upland sources the average was 133 per 100,000 per annum.

A curious feature is the striking resemblance between the Birkenhead and Liverpool case-rates for the first few years from 1892. A much greater typhoid incidence at Liverpool also occurred during those years than subsequently. This circumstance was somewhat perplexing, because it seemed highly improbable, if the typhoid was communicated by the public water-supplies, that waters obtained from two sources so widely separated both geographically and geologically as those of Birkenhead and Liverpool should produce a typhoid incidence so closely resembling each other, and the explanation seemed to demand the assumption that during those years a much larger proportion of the total supply to Liverpool was obtained from the new red

sandstone wells than in more recent years. Upon inquiry I learned that from the beginning of 1892 until October, 1895, 30 per cent. of the total supply was obtained from sandstone wells. From that date until the end of 1897 the quantity of well-water was considerably reduced, and from the end of 1897 to the present time the quantity has been only 13 per cent. of the whole.

It was apparent that, during the whole of the first-mentioned period, with the sole exception of the second quarter of 1895, the Liverpool and Birkenhead curves maintained a striking resemblance, and that from about the end of the third quarter of that year the typhoid incidence itself at Liverpool diminished as well as its resemblance to Birkenhead. The average case-rate of the three periods at Liverpool are as follows: With 30 per cent. of well-water from the beginning of 1892 to October, 1893, the case-rate averaged 227 per 100,000 per annum, as compared with an average of 174 at Birkenhead; from October, 1895, to December, 1897, when the quantity of well-water was largely reduced (I am unable to give the exact amount of reduction), the rate averaged 169, as against 146 at Birkenhead. From the beginning of 1898 onwards, when the proportion was 13 per cent., the case-rate averaged 132, Birkenhead being for the same period 192.

It seems very difficult to resist the conclusion from these facts that (1) the water-supply was responsible for the greater part of the typhoid in both these towns, and (2) that in the case of Liverpool it was greatly increased by the water obtained from the artesian wells.

If these conclusions be correct, the above figures furnish us with data upon which one might, with a considerable degree of probability, predict what would be the average typhoid case-rate of Liverpool if she ceased entirely to drink the well-water. If a reduction from 30 per cent. to 13 per cent. effected a diminution in the average typhoid of 95, then eliminating the 13 per cent. may be expected to produce a further reduction in the average of 73, bringing the case-rate of Liverpool down to about 59 per 100,000 per annum, a figure below that of

Manchester, as might be expected, since Liverpool filters her Vyrnwy water, while Manchester delivers the water to the consumer without filtration.

Turning again to the typhoid incidence of the nine towns selected, it was noticed that the typhoid in London was distinctly higher than that of the two other river-supplied towns.

I was aware that a portion of the London water was obtained from chalk wells and sources other than the Thames. I was, therefore, anxious to ascertain whether that circumstance afforded any explanation of the greater proportion of cases in the Metropolis than in Reading and Worcester.

Particulars of the typhoid incidence in the districts supplied by the various Metropolitan water companies were accordingly obtained for the five years ending 1899.

The following were the case-rates per 100,000 per annum. The districts served by the three companies which supplied filtered Thames water only—viz, the West Middlesex, the Chelsea, and the Grand Junction, 64; the districts served by the Southwark and Vauxhall and the Lambeth Companies, which supply a small proportion of unfiltered well-water with that from the Thames, 80; the districts served by the New River Company, which supplies a still larger proportion of unfiltered well and spring water, 82; the East London Company, which also delivers a large proportion of chalk well-water, 116; and the Kent Company, which supplies well-water exclusively, 76.

It is clear from these figures that putting London into the series of river-supplied towns inflicts upon that group a disadvantage in consequence of some of the water to the Metropolis being obtained from artesian wells.

Reflecting upon the foregoing facts, comprehending as they do immense populations, suggested the probability that a similar order of things would be found generally throughout the country. I therefore collected statistics of the enteric incidence for the five years ending 1899 of all the towns with populations exceeding 10,000 whose health returns appear in the Local Government Board's annual reports, and classified the towns under their respective sources of water-supply. These were grouped as

follows: (1) Towns supplied from wells sunk in the new red sandstone; (2) from wells sunk in the chalk; (3) from upland sources; (4) from mixed sources; (5) from rivers.

Briefly summarized, the average annual case-rate of group (1) for the period mentioned was 117; group (2), 109; group (3), 119; group (4), 91; group (5), 82.

The new red sandstone is manifestly associated, almost without exception, with a high typhoid incidence, and with few exceptions towns supplied with unfiltered water from whatever source is accompanied by a greater typhoid rate than towns supplied with filtered water.

A somewhat interesting feature was noticed in the case of the towns supplied from rivers. These towns formed two quite distinct groups, the group A comprising towns in which the highest average for the five years of any of the towns did not exceed 54, and group B, comprising towns in which the lowest average for the same period of any of the towns was 122. The average rate of all the towns in group A was 48; that in group B, 182. The towns in the former group are Carlisle, Devonport, Oxford, Reading, and Worcester; those of the latter Ashton-under-Lynn, Darlington, Exeter, York, and Middlesborough.

Now, if it can be shown that the towns in the latter group of class (5) possessed inadequate provision for efficient filtration, or did not, in fact, efficiently filter their water, these towns will afford additional evidence that the typhoid case-rate is an index of the hygienic purity of the water-supply. This was certainly the case with regard to one of the towns in the group—viz., Exeter. The City Council of Exeter, recognising the insufficiency of the filtering area, and acting upon the advice of their engineer, applied to the Local Government Board for sanction to raise a loan for improving their waterworks. The works, which included an addition of 100 per cent. to the filtering area, were completed, I believe, about the beginning of 1901. I was interested to ascertain what effect that improvement would have upon the next typhoid season, which generally occurred in the third and fourth quarters of the year.

Several months, no doubt, elapsed before the filters attained their normal efficiency.

The result upon the enteric case-rate for the latter half of last year was as remarkable as it must have been gratifying to the Council of this ancient city. The number of cases, which during the latter half of the three years preceding 1901 averaged 70, fell in 1901 to 15.

This was precisely what my experience at Worcester in 1895 led me to expect. The record so far for the present year promises a still further improvement.

It is as difficult to resist the conclusion that the public water-supply was the origin of the typhoid in Exeter as it is to escape the conviction that its reduction is due to the improvement in the filtration.

In future Exeter should rank among the towns whose enteric case-rate is less than 50 per 100,000 per annum.

With regard to the other river-supplied towns whose typhoid case-rate is high, I regret that I have no information which enables me to say whether adequate filtering arrangements are provided, but observations of those towns which I know possess ample filtering area and proper supervision lead me to think that improvements in those respects would produce effects not different from those of Worcester and Exeter.

Frequent, say *weekly*, bacteriological examinations of the water would readily determine the efficiency of the filtration in those towns, and such examinations should be practised in every works supplying filtered water.

Many instances of epidemics of enteric fever which have been investigated and reported upon by the Local Government Board Inspectors and Medical Officers of Health will be remembered. Some of these have been satisfactorily traced to the public water-supply, as the Tees Valley outbreak in 1890-1891. The origin of others has been considered doubtful, while some it has seemed almost impossible to attribute to the water. A very few have been traced to milk-supplies, but even these have generally been regarded as originating in some infected well, the water from which has been used to wash the dairy utensils.

The outbreak in Chichester in 1896 could not be traced to any milk-supply, and the circumstances quite negatived the notion that the public water was responsible for it. The epidemic did not occur in the months when enteric generally prevails—viz., October, November, and December. It began in July, reached its maximum in August, and disappeared at the end of September—that is, during precisely the period when aerated waters are largely drunk. If such drinks caused the outbreak it doubtless proceeded from an infected well, in which case it would afford additional evidence that the water-supply—not necessarily the public water-supply—is that to which attention must be directed in endeavouring to stamp out this disease.

On the Continent the town of Munich, which some years back suffered from a high typhoid incidence, was for many years the subject of observation and investigation by the late Professor Pettenkoffer, who arrived at the conclusion that the disease was in no way connected with the water supplied to the town. The chief facts have been embodied in an interesting paper by Dr. Childe. I have carefully perused Dr. Childe's pamphlet, and if it contains all that is necessary to know in order to arrive at a correct conclusion as to the origin of the disease, I am bound to say that in the light of present knowledge I am astonished at Pettenkoffer's conclusion, and entertain no doubt that the water-supply of the town was responsible for the typhoid. There does not appear to be a single fact recorded in the pamphlet inconsistent with the hypothesis, and there are some which it is difficult to explain upon any other.

Attention has already been drawn to the recurrence of the typhoid maximum in the autumn and winter quarters at Worcester prior to 1894. It will be still more strikingly observed in the river-supplied portions of London, where the form of the typhoid curve scarcely differs from year to year, each quarter having its distinctive ratio, the maximum invariably occurring at the season when the raw river-water is usually inferior.

This affords an indication that, notwithstanding the excellent results obtained by the London water companies which supply Thames water as compared with other towns throughout the

kingdom, there is still room for improvement; this is further confirmed by the fact that the enteric case-rate of those districts exceed those of other towns, as Oxford, Reading, and Worcester, supplied with filtered river-water.

The returns show that Birmingham has suffered from a somewhat high enteric case-rate.

It will be interesting and instructive to observe what effect upon it the new water-supply to Birmingham will have. Remembering the splendid provision for efficient filtration which is being made by the distinguished engineer of those works, I anticipate a very large reduction in the typhoid incidence, particularly if the present supply is entirely abandoned, or if not, then subjected to equally perfect filtration as the Welsh water.

I am conscious of the responsibility I incur in attributing almost universally to the water-supplies the typhoid incidence, not only of this country, but of many others; but in a matter of such serious import as the public health, I have felt bound to give expression to my convictions, hoping that others may pursue the investigation further, and believing that in the end only good can result therefrom.

In a matter involving a large collection of statistics and computations, I am aware that errors may have crept into my figures; but I have done my best to avoid them, and believe that the facts I have submitted are substantially correct.

I desire to thank those gentlemen who have kindly assisted me in giving me information when asked for, and particularly am I indebted to my assistant, Mr. F. R. Phipps.

LECTURES IN PRISONS.

Miss Smith Rossie, an Associate of The Royal Institute of Public Health, has, with the permission of the Home Office and the local authorities, undertaken the delivery of lectures to the female convicts at His Majesty's Prison at Portsmouth, on the care of children, hygiene, nursing, and sanitation. We shall watch this experiment with close attention, because there can be no doubt as to the nature of the connection between crime, ill-health of body and mind, and unsanitary conditions of life.

USE OF MOLASSES AS A FOOD FOR ANIMALS.*

BY

VETERINARY LIEUTENANT-COLONEL J. A. NUNN, F.R.C.V.S., C.I.E., D.S.O.,

Deputy Director-General, Army Veterinary Department.

FOR many years past cattle have been fed on the Continent on the refuse of the beetroot sugar, and, in fact, a herd to consume it is part of the equipment of a French sugar factory, but the use of cane-molasses is of a recent date. In the proceedings of the Agricultural Society of France for 1890 there is a report upon some experiments made in Germany by M. Sidersky, recommending that it should be dissolved in hot water and sprinkled over the food. He further suggested that the molasses should be put into a bag, and suspended overnight in a tub of water, which will dissolve it, and it can be used next day. He does not recommend that it should be used in a concentrated form with dry food, as it is almost impossible to mix them together.

MM. Ramm and Momsen also carried on a series of experiments in feeding with raw sugar and molasses, and clearly demonstrated the superiority of the latter.

At the present time there are a number of feeding materials composed of molasses, a table of which is published in a recent work by M. Lavalard, and I would particularly call your attention to one composed of peat-moss and molasses, a preparation that is used as an emergency ration in the German army, but which has not yet penetrated to ours.

In 1899 M. Grandeau carried out some experiments at the stables of the General Carriage Company of Paris on three horses, who for eighteen months, in addition to their usual ration of chaff, beans, and maize, received 2½ kilogrammes of Vaury's horse bread, a composition of wheat and 40 per cent. molasses, which would represent about 1 kilogramme per diem. The horses remained in good condition and health, and varied but little in weight.

* A paper read at the Exeter Congress, 1902.

M. Lavalard has carried out some extensive experiments on the horses of the Paris General Omnibus Company, the material used being a German one, "molassine," and a French one, "melasse tourbe." Both are composed of molasses and moss, 80 to 86 per cent. of the former to 20 to 14 per cent. of the latter, and of which he gives the following analysis:

ANALYSIS OF PEAT-MOSS AND MOLASSES FROM THE SAY SUGAR REFINERY.

Water	19·00
Nitrogenous material	9·77
Starchy	53·81
Fatty	0·34
Mineral	9·31
Cellulose	7·77
	100·00

ANALYSIS OF ASH OF THE ABOVE.

Carbonic acid	2·529
Phosphoric	0·032
Chlorine	0·363
Potash	3·554
Soda	0·953
Silica	0·411
Lime, magnesium, oxide of iron, and sulphuric acid	1·468
	9·310

The experiment was commenced on July 7, 1901, with twenty-four horses, which at first received ½ kilogramme of molasses in lieu of a like quantity of grain, which was subsequently increased to 1½ kilogrammes, and gradually all the horses of the company—about 14,000—were put on from 1 to 1½ kilogrammes of it.

It was remarked that on this régime the number of cases of colic were greatly diminished, and that there was not a single one of diarrhœa in the entire stud; also that the horses invariably

finished the whole feed, whereas with the ordinary ration a portion was frequently left.

Since December, 1901, the first twenty-four horses have been getting 3 kilogrammes per diem of peat-moss molasses in lieu of the same amount of grain. They have been weighed every eight days, and have not lost flesh, although they have been doing their usual work.

M. Lavalard has been conducting a further series of experiments, with a view to testing the truth of the statement of M. Grandeau and certain other French authorities that the peat-moss exercises an inhibitory action in the digestion of the other constituents of the food. These have not yet been completed, but when they are he intends to publish them. However, he has come to the conclusion that every sort of moss is not fit for the purpose, and that the only one that should be used is peat-moss, after it has been cleaned and separated from the sand and earthy material that adheres to it. He considers that it acts as a corrective by virtue of the tannic and humic acids, neutralizing the alkaline matters in the molasses and rendering them innocuous. It also acts as a vehicle, absorbing the molasses like a sponge, and making it easy to transport; but this depends on the nature and degree of dryness of the moss, which varies, specimens examined containing from 8 to 36 per cent. of water. The analysis of different sorts of peats, by Dr. Quesneville is taken from the *Moniteur Scientifique* of February, 1901.

ANALYSIS OF PEAT-MOSS.

	Light Peat-Moss, Hanover.		Heavy Peat-Moss, Oldenburg.	
	I.	II	I.	II.
Water	30·0	29·0	20·0	21·0
Ash	3·0	3·1	2·8	2·0
Fibres	55·0	54·9	49·0	47·0
Humic acid	12·0	13·0	28·2	30·0
	100·0	100·0	100·0	100·0

Another series of experiments were undertaken in Germany by the Agricultural Association of Göttingen, and the following conclusions arrived at:

1. There is no danger in giving a horse a daily ration of at least 1 kilogramme of good peat-moss and molasses, 20 to 80 per cent.
2. That this can with advantage replace an equal quantity of oats.
3. That the general health and muscular energies remain perfect, and the coat assumes a brighter gloss.
4. That in animals subject to indigestion and attacks of colic the severity of the symptoms diminish or altogether disappear under this régime.
5. That there is a saving of at least 40 to 50 centimes per head per diem.

In the *American Veterinary Review* of February, 1902, Dr. Griffin, Veterinary Surgeon of the 5th United States Cavalry, publishes his experience in Porto Rico during the Spanish War, from 1898 to 1901. In that country maize was scarce and dear, and such as could be obtained was small, poor, and hard. Oats had to be imported from America, and hay was unknown. Grass, however, in any quantity could be cut, but it was green, and contained 85 per cent. of water. Under these circumstances, Dr. Griffin, noticing that the negroes gave molasses in considerable quantities to their ponies in water, which they readily drank and did hard work on, and, finding it could be easily obtained, resolved to try it in his own regiment.

The experiment was made on eight horses, and lasted from January 1 to May 31, 1899.

The subjects were weighed and carefully examined, especially as to their teeth and general state of health.

On January 1 the ration of oats was reduced by 3 lb., 9 lb. of green grass being given in lieu.

On January 4 the hay was reduced, 2 lb. of grass being substituted for each pound of hay.

On January 6, 3 lb. of molasses were added to the grass, 21 lb.,

and well mixed in with it. It was refused by all except one horse, who was very greedy for sweetmeats and sugar. At the next feed 25 per cent. of water was added to the molasses, and five horses ate it readily.

On January 10 all were getting 35 lb. of grass and 14 lb. of molasses daily, without anything else, and ate it with good appetite.

From January 7 to 18 each horse lost 25 lb. to 30 lb., but the bowels were not relaxed. The urine was increased in quantity and clear, but without sugar. During this time the horses were performing the usual garrison march, but it was decided to increase it.

The routine was as follows: Watered at 6 a.m. and fed, 15 lb. of grass, 7 lb. of molasses; at 7.30 saddled and mounted, 1 mile walking, 1 trotting, 1 walking, 1 canter, 2 walking, 1 gallop, 1 trot, 2 walking; return to stables at 9.30; 4.30 fed, 20 lb. of grass, 7 lb. of molasses.

On January 20 they commenced to regain condition, and by February 5 were at their normal weight, and by the end of the month they had increased from 35 lb. to 68 lb., which was maintained.

On April 20, by mistake, the molasses for the morning feed was taken from a barrel in a state of fermentation, and, to use Dr. Griffin's words, "the behaviour of the horses was most outrageous."

Dr. Griffin comes to the following conclusion:

1. In the West Indies, when the regular ration cannot be obtained, horses can be fed on grass and molasses, and worked without losing condition.
2. The regulation ration costs 75 cents per diem; grass and molasses 15 cents.
3. Thirty-five pounds of green grass and 13 lb. to 15 lb. of molasses is sufficient to keep a horse weighing 1,000 lb. in good working condition in a climate like Porto Rico.

Professor Tanner, in an article in the *Journal of the Royal Agricultural Society of England*, 1865, points out that the excessive

use of sugar diminishes the reproductive powers of breeding animals, and considers it doubtful, if they have been fed on it for any length of time, if they ever regain them. He also points out that this property makes it useful for fattening stock, as it has the effect of suppressing those periodical returns of restlessness which prevent heifers feeding as well as steers.

Stephen's "Book of the Farm," vol. i., p. 262, mentions that in many herds it is used to get young bulls into show condition, much, however, to the detriment of their breeding powers.

From an analysis made by M. Girard, Professor of the National Agricultural School of France, there appears to be a difference between the molasses obtained from the sugar-cane and beetroot,

ANALYSIS OF SUGAR-CANE MOLASSES.

Water	18·55 to	19·50
Mineral	2·30 ,,	2·66
Sugar	34·63 ,,	34·25
Glucose	32·87 ,,	29·75
Organic materials, various	11·65 ,,	13·84

ANALYSIS OF BEETROOT MOLASSES.

Water	18·10
Mineral	12·74
Sugar	49·00
Glucose	traces
Organic materials, various	19·86

In India it is a usual thing for the drivers of the country cart, or *eka*, to give their ponies unrefined sugar, made up with coarse wheat or barley-meal, when going on a journey, and some of the distances they perform are very long. The native horsedealers also use it and sugar-cane to get animals fat for sale.

COW-POX.

BY

P. G. BOND, M.R.C.V.S.

THE subject of my paper as a small contribution to the Veterinary Section of this Congress is that of *Variola vaccina*, or cow-pox, in its relationship to man, and as a remedy against small-pox, coming under the category of diseases communicable from the lower animals to man, and its effects on the human system.

It may not be out of place to mention a few facts about the disease: the prophylactic effect of its introduction into the human blood-stream, the course it runs, the symptoms exhibited, the effects on the person, and the protection it is capable of affording against the small-pox.

The recent outbreak of small-pox in London and elsewhere has drawn the public attention to the remedy of vaccination—that is, the introduction into the human system of the specific contagium of cow-pox, which, having run its normal course, leaves the system proof against an attack of small-pox. Williams, in his "Veterinary Medicine," describes cow-pox to be a contagious febrile and eruptive disease, known in most parts of the globe, resulting from the presence of a specific fixed virus, which is reproduced and multiplied in the animal body during the course of the malady. After a period of latency of from six to nine days, the contagium causes the development of an eruption on the surface of the mammary gland, which eruption passes through the stages of pimple, vesicle, pustule and scab.

The disease runs a definite and mild course, and destroys the susceptibilities of the affected animal to another attack, but in hot climates it sometimes assumes a diffuse and severe character.

Cow-pox was formerly described by high medical authorities as a malignant disease, which destroyed cattle almost as extensively as small-pox did the human race.

This view of the malignancy of cow-pox is evidently the result of a pathological error, which led observers to confuse the

cow-pox with cattle plague. Jenner believed in the identity of cow-pox and small-pox, and that both had a common origin in the grease of the horse. Jenner did not, however, perform any inoculations of cattle with the lymph of human small-pox. The first successful experiment of inoculating the cow with human small-pox was performed at the Berlin Veterinary College in 1801, the efforts previously having been unsatisfactory.

The contagium of cow-pox is an extremely small form of micrococci, usually called the *Diplococcus variola et vaccinia*, in clear lymph, but in opaque orange and brown lymph there may be three or even four forms of micrococci. Some observers are of opinion that, although the germs may not be actually special forms of the yeast organism, yet at least both vaccination experiments with yeast and cultivation investigation seem to point to a similar origin. When once the disease breaks out in a dairy it is apt to spread to the whole herd, unless precautions are taken by segregation of all affected animals and the employing of separate attendants, care being taken at all times that the milker of an affected cow shall not touch a healthy one. In all ordinary cases of the disease non-interference is to be strictly observed. It has not been determined whether small-pox poison originated in man, the cow, or the horse. Whether man had the disease communicated to him from the lower animals, or whether horses and cows had it from man. The origin will most probably remain a mystery, and we must be content with the knowledge that through the keen penetration of Jenner the disease directly communicated by vaccination from the lower to the higher animal has proved a blessing to millions of the human race.

I have never heard of a case of cow-pox having been conveyed to the human being through the agency of the milk.

Cows are subject to two distinct species of pustular eruption of the teats. In the one little vesicles or bladders appear, which often differ considerably in size and form, and are filled with a purulent matter; in the course of a few days a scab forms upon them, which peels off, and the part underneath is sound. If the pustules are rubbed off in the act of milking, or in some other

way, small ulcers are left, which are very sore and sometimes difficult to heal.

The cause of this eruption is unknown, except that it is contagious, and is readily communicated from the cow to the milker if the hand is not quite sound, and from the milker to the other cows.

There is a second kind of pustular eruption of a more important character, and with which the previous one has been confounded. It also consists of vesicles or bladders on the teats, but they are larger, circular, and with a little central depression. They are filled at first with a limpid fluid, which by degrees becomes opaque and purulent. This is more decidedly a constitutional disease than the former. The cow exhibits evident symptoms of fever; she does not feed well. Sometimes she ceases to ruminate, and the secretion of milk is usually diminished. The pustules pass through a similar course as the former ones. They dry up, and at length the scab falls off, leaving the skin underneath sound; but if they are broken before this the ulcers are larger, deeper, of a more unhealthy character, and generally far more difficult to heal. This is the genuine cow-pox.

There is some difficulty respecting the cause of the disease. It is as contagious as the other, and perhaps usually propagated by contact, but it occasionally appears when there does not seem to have been a possibility of contact, directly or indirectly, with any other animal previously affected. It was the opinion of Jenner, and is still possibly the opinion of many medical men, that the cow-pox originated from infection by the matter of grease in horses, and which had been conveyed to the teat of the cow by means of the unwashed hands of someone who had the care of the horses, while he was occasionally employed in the dairy.

Only last month I heard of a medical man warning a farmer against allowing a horse affected with grease to run at grass, as it was very infectious and would be likely to affect his cows. This, when brought to the test of experience, has been proved to be altogether erroneous. A pustular disease has been communicated by contact with the matter of grease, but it resembled far

more the spurious vesicle that has been described than the genuine cow-pox. In a great many instances, however, nothing that could be considered as bearing any analogy to the true vaccine disease followed inoculation with the matter of grease. Whatever may be the opinion of medical men, it will be very difficult to find a veterinary surgeon, whose life is spent amidst these diseases, and who is well acquainted with the matter, cause, and effect, who believes that grease is the origin of cow pox, or that there is the slightest connection between them. Dr. Quain states cow-pox to be a natural disease of the horse. I have never seen it in the horse.

The next interesting circumstance connected with pustular eruption is that the persons on whom it appeared were for a considerable period, and it was once thought during life, protected from the small-pox.

This was known among farmers from time immemorial, and that not only in England and almost every part of the Continent, but also in the New World. The majority of medical men, however, had regarded it as a mere popular error, and to no one whom experience had convinced of the active protective power of cow-pox had it occurred to endeavour to ascertain whether it might not be possible to propagate the affection by inoculation from one human being to another, and thus communicate security against small-pox at will.

To the mind of Jenner, then a surgeon at Berkeley, in Gloucestershire, the probability of accomplishing this presented itself. He spoke of it to his medical friends, but from every one of them he met with discouragement.

They sportively threatened to banish him from their clubs if he continued to tease them with his wild speculations. For more than twenty years he brooded on the subject ere he could summon sufficient resolution to oppose himself to the ridicule of his friends and of the profession generally by making the decisive experiment.

At length he inoculated a boy with the matter taken from the hands of a milkmaid who had been infected by her master's cow. The disease was communicated, and with it the immunity

that was expected. He multipled his experiments, and he was successful in all of them; and although his brethren and the public were slow to believe him, he at length established the power of vaccination, and proved himself to be one of the greatest benefactors of the human race that ever lived.

This account of the progress of vaccination is not out of place, since the prophylactic against small-pox, was derived from the animal, the consideration of whose general and medical treatment comes under the supervision of the veterinary surgeon.

Jenner was not the first to try inoculation: it was first done by one Benjamin Jesty. An extract from the *Daily Graphic* of February 15, 1902, states: "In view of the small-pox epidemic, the little churchyard of North Matravers, near Wareham, is just now an interesting spot, owing to the fact that there lie the remains of Benjamin Jesty, who, according to the inscription on his tombstone, was the first person known to experiment with cow-pox inoculation."

It is also interesting to note that at the present time there is living at North Matravers a man whose mother was inoculated by Jesty. The inscription on Benjamin Jesty's tombstone, which is distinctly decipherable, reads as follows: "Sacred to the memory of Benjamin Jesty, of Downshay, who departed this life April 16, 1816, aged seventy-nine years. He was born at Yetminster, in this county, and was an upright, honest man, particularly noted for having been the first person known that introduced the cow-pox by inoculation, and who, from his great strength of mind, made the experiment from the cow on his wife and two sons in the year 1774."

This was twenty years before Jenner made his experiments.

As there are no qualifying initials attached to Jesty's name, he was probably one of the early veterinaries or cattle doctors, evidently a keen observer.

In June, 1887, a rather extensive outbreak of the disease occurred in the neighbourhood of Plymouth. At the same time an outbreak of diphtheria occurred at Devonport. The cause of this was assigned to various sources: as, *e.g.*, the unsatisfactory condition of the drainage, the contamination of the drinking-

water from Dartmoor (the troops having been stationed there for manœuvres that year) and to an outbreak of scarlatina or scarlet-fever amongst the cows of the district, the source of which was said to be traced to the use of milk from one particular herd of cows. I remember examining these cows, and finding them free from disease. Investigation became then more complete, and it was found that the affection of the cows' teats and the disease affecting the human being at that time had nothing in common.

Since that time I have frequently seen it, and it will continue to show itself; but we do not hear of anything following prejudicial to health, and the affection to my mind is quite harmless.

The treatment of the affection in cows is simple. Mild saline aperients internally, with the local dressing to the udder and teats of liq. plumbi. 1 part, olive oil 5 parts, mix, and apply with a soft sponge or rag to the teat, is all that is required, with the washing of the hands before going to another cow.

Of the effect of vaccination I need not here remark. I remember being told by the late Dr. Ford, of Kingsbridge, that in his early days it was not unusual to find one in eight of the people he met in the streets showing marks of having had small-pox. It is very rare indeed now.

The Registrar-General's annual summary relating to the health of London and of many of the largest English towns has just been issued, July, 1902 :

" During last year 242 fatal cases of small-pox were registered among persons belonging to the thirty-three large towns. Of these, 229 belonged to London, 6 to Liverpool, 4 to West Ham, and 1 each to Plymouth, Cardiff, and Newcastle."

I am of opinion that sufficient evidence has been produced to justify the faith placed in the inoculation of the human being by the virus of the *Variola vaccina* as a remedy affording protection from small-pox.

THE MORTALITY IN THE SOUTH AFRICAN WAR.

We have received a copy of a valuable paper recently read before the Institute of Actuaries by Messrs. Schooling and Rusher, actuary and assistant actuary respectively of the Prudential Assurance Company, Limited, on the subject of the mortality experience of the imperial forces during the war in South Africa, October 11, 1899, to May 31, 1902. Certain facts are brought out clearly by the authors, which may be briefly summarized as follows: There were twenty-five men engaged in the war to one officer. Ten men were killed by wounds for one officer, and thirty-eight men died from other causes for every one officer. The causes to which this is due are, firstly, that in action the officers were specially singled out by the enemy, and the mortality among the officers from wounds decreased when they discarded badges of rank and other marks which distinguished them from the rank and file. In the second place, the officers were drawn from a section of the community whose power of resisting disease is greater than that from which we obtain the non-commissioned officers and men. Again, it may also be that the officers recognised more thoroughly than the men the value of the sanitary precautions as regards drinking-water, etc., which were from time to time impressed upon the army in the field. Perhaps, also, the care in hospital bestowed upon the officers exceeded that given to the men, though there are very few facts to warrant such an inference. As the authors remark, the "death-rates from other causes uniformly tended to rise during December and January. This is the height of the South African summer, a season which is generally considered by the medical profession as productive of excessive mortality from enteric fever." In June, the period of mid-winter in South Africa, there is an increase in mortality due to intestinal catarrh, which Dr. Washbourn states to originate in chills, which in England would cause nasal catarrh.

The authors clearly prove the intimate connection between the phases of the mortality and the incidents of the war. While active operations were in progress the mortality from wounds

increased; while the army was at rest, as at Bloemfontein, the mortality from other causes increased. The regulars, who at first bore the brunt of active operations, and were then in the later stages of the war employed in blockhouses, suffered from a high initial mortality from wounds, which decreased as the men became experienced in the conditions of South African warfare and as the system of warfare adopted by Lord Kitchener provided the advantages of cover in blockhouses. The Yeomanry and Colonials, mounted troops, were in the later period of the war more constantly employed in operations of offence. The mortality of the Yeomanry from wounds was greater than that of the Colonials from that cause, while after the first stage of the war the regulars had the lowest death-rate of all.

The case does not admit of such simple explanations when we consider the mortality from other causes. Here we have prominently to notice the low death-rate among Colonials, which is attributed to the fact that the conditions of life in the various colonies which sent contingents approximated so closely to those of South African life that Colonials of all kinds were better prepared to fight the causes that produce disease than were the troops from the mother country. It is gratifying to be able to note that the authors ascribe the steady tendency of the rates among the regulars to decrease to the efficiency with which the Medical Department of the army did its work. As regards the Yeomanry, there is probably something in the contention that the second draft was inferior in physique to the first, which by the end of the war had gone through a longer period of acclimatization. Undoubtedly as the war lasted men became more inured to hardships and exposure; the weaker died or were invalided home. The medical organization also became more perfect, with the result that the mortality from other causes steadily diminished. The age factor is shown to be unimportant in comparison with the effect of the incidents of the campaign and the length of the period of exposure.

The following shows the yearly death-rate for all arms (Regulars, Volunteers, Yeomanry, Colonials, etc.) for different periods of the war:

	Officers.	N.C.O.'s and Men.
	Per Cent.	Per Cent.
February 1, 1900 to January 31, 1901 -	6·34	4·81
,, 1, 1901 ,, ,, 31, 1902 -	3·89	2·90
,, 1, 1902 ,, May 31, 1902 - -	4·51	2·90

NOTE.—*It should be remembered that in no other war were so many men employed in guarding communications.*

The death-rate per annum over the whole period for all the forces engaged was 3·87 per cent., which is less than the average death-rate of the army in the field based on campaigns extending over nearly 100 years, and is little more than half the death-rate of the American Civil War.

It is obvious, therefore, that we are more than ever justified in insisting upon the need of sanitary knowledge and the use of sanitary methods in the Army Medical Department. The secret which this valuable paper discloses has been long familiar to us. Prevention is better than cure. With the phenomena of the mortality from wounds we have nothing to do. It is our business to insist that in times of peace, by the diffusion of professional knowledge, everything should be done that can be done to perfect the medical organization of the army; and that department notoriously needs strengthening by the inclusion of a sanitary expert at headquarters. It is very useful to teach the soldier the principles of first aid, but many a valuable life would have been preserved if measures had been taken in time to disseminate among all ranks of the army the first principles of the science of preventive medicine, by which alone could they successfully maintain the combat with a foe far more deadly than the bullet of the Boer. It is clear that the army showed great power of adaptability by appreciating the value of taking cover and of the need for precautions when dealing with a clever enemy in the field. It is not too much to expect that the Army Medical Department will display similar powers of adaptability by devoting more of its energy to the prevention of disease.

DEFECTIVE VISION IN THE LONDON BOARD SCHOOLS.

In April, 1902, the London School Board appointed eight temporary oculists to test the eyesight of school-children in London. The Medical Officer has now issued a report on their work, the conclusions as to visual conditions being as follows:

1. The percentage with normal vision increases with every year of age, and standard of advance during school-life, reaching 80 per cent. with Standard VII.
2. Ten per cent. all through school-life have "bad" vision—this remains about a constant proportion.
3. The greater part of the defective vision is due to slight defect which gives imperfect but fair vision, due probably both to mental and ocular conditions, and of greatest importance educationally in the first half of school-life.
4. Very bad visual acuity (6/36 or worse), due to accident, disease, and probably also to spasm and myopia, is met with in a small proportion, increasing regularly from 1·5 per cent. in Standard I. to 3·5 per cent. in Standard Ex-VII.

"The percentages of defect appear to vary more with the social and nutritive conditions of the children, and with racial peculiarity than with any school conditions. School effects from fine work and poor illumination are more likely to show themselves in general nerve-strain and unhealthy neurotic, nutritional conditions, than in very defective visual acuity during school-life."

There appears also to be an association between defective visual acuity and retarded position in school. Ill-health, defective vision, retarded position in school, are necessarily connected, and the lesson which this fact teaches is that it is the bounden duty of the State, in its own interests, to see that the school-children of to-day, the citizens of the future, are properly fed, are housed in sanitary dwellings, are taught in schools which are properly lighted and ventilated. The work of co-ordinating the educational authorities of the country is nearing completion, and we see with regret that no provision has yet been made for adding to the staff of the Board of Education a medical officer, whose duty it should be to see that throughout the country the schools are properly equipped and lighted, and that the various medical problems arising out of educational administration receive the attention which, from their real importance, they deserve. Necessary as it is to secure a diffusion of sound knowledge of hygienic principles, it is at least as necessary to see that people have the means of putting their knowledge of hygiene into practice. The best friend of the poor is the Medical Officer of Health, but his efforts can avail but little unless supported by a strong force of intelligent lay opinion.

BACTERIOLOGICAL NOTES.

I.

BACTERIOLOGY FOR GENERAL PRACTITIONERS AND JUNIOR MEDICAL OFFICERS OF HEALTH.

BY

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(*Continued from page* 231.)

"BACILLUS TYPHOSUS" (EBERTH-GAFFKY).—The general practitioner is advised not to attempt the isolation of the bacillus of typhoid fever from the body. It is a difficult process, as the organism is in form so like the *Bacillus coli communis*, which is more generally met with, that several special tests are necessary to distinguish one from the other. For purity of culture, it is best obtained from the spleen pulp of a person dying from enterica. It may also be isolated from the liver, Peyer's patches before ulceration, mesenteric glands, and the fæces after ulceration of Peyer's patches, though it is useless attempting to find the organism by direct microscopic examination of the stools. The bacilli are also to be found in the urine, being often present in extraordinary numbers, and more rarely in the blood, which is not a good culture medium, and rose-spots of a person so suffering.

In the case of the urine Horton Smith has shown that the organism is present as a pure culture in about 35 per cent. of the cases of typhoid fever, especially in the later stages and during convalescence, this latter being a most important practical point as regards the spread of infection, for until recently little or no pains have been taken to disinfect the urine, either during the illness or, what is more important, during convalescence. And I would here point out the great advantage of treating all typhoid patients—especially in the later stages of the disease, when there is typhoid bacilluria — by means of the urinary disinfectant

urotropin, as originally suggested by Richardson. The drug should be given in doses of 20 or 30 grains daily, with plenty of water, for two or three weeks. I have never found any ill effects from such a procedure. Urotropin is a derivative of formalin (which is probably one of the most efficient bactericides at the present time), and, according to Nicholaier, this substance is freed in the urinary passages, which probably accounts for the disappearance of the bacilli from the urine. Certain it is that tubes inoculated with the urine, after such treatment, usually remain sterile.

B. typhosus grows readily on gelatine or agar in stroke culture, or in nutrient broth, being easily visible in these after twenty-four hours' incubation at 37° C. (98° F.). On agar it forms a moist grayish or bluish-white growth, with irregular, wavy edges, and somewhat raised from the surface. The growth has a slightly iridescent appearance. In broth, which is inoculated by transferring a loopful of infective material from an agar or other culture, and stirring it in once or twice, it forms a characteristic turbidity after twenty-four hours' incubation. On gently shaking the tube, we will observe a peculiar iridescent, cloudy effect, and if a loopful of this broth culture, not over twenty-four hours old, be mounted as a "hanging drop" on one of the hollow slides or simply on an ordinary one, and examined under the immersion lens, we will see what an actively motile organism we are dealing with, the bacilli being observed darting and rolling about very briskly, the movements being due to the flagella which the organism possesses.

The bacillus is readily stained by any of the basic aniline dyes, carbol-thionin and dilute carbol-fuchsin giving excellent results. It is not stained by Gram's iodine method. The organism rod-shaped, somewhat shorter and thicker than *B. tuberculosis*, and as a rule there are a few elongated, threadlike forms to be seen, this being a characteristic point, otherwise the microscopic appearance is not always sufficient to distinguish it from several other organisms. These long, serpentine forms are most frequently met with in broth cultures.

To stain the flagella of *B. typhosus* is a somewhat difficult

process, but one well worth the trouble involved. Several different methods are recommended, but I prefer Richard Muir's modification of Pitfield's, which gives beautiful results. The stains in this case must be always freshly prepared. De Rossi's method is simpler, and the stains are more stable, but the results in my hands have not been so good as with the former method. Young cultures on agar must always be used, and in any case considerable patience and practice is necessary to obtain good results.

Grüber-Widal Reaction.—This diagnostic method, usually known as Widal's Test, can, with a little extra trouble, be carried out by the general practitioner. The rationale of the process lies in the fact that if *blood-serum from a person suffering from typhoid fever*, after the sixth or seventh day of the disease, is properly diluted with sterile broth, and mixed with a living, actively motile culture of typhoid, these motile bacilli (1) *lose their motility* and (2) *aggregate into "clumps."* This seldom occurs with normal blood-serum. The "agglutination" phenomenon should take place *within half an hour* (certainly in one hour) *with a dilution of* 1 *part of blood-serum to* 30 *parts of broth*, in order to give a *positive reaction.*

Brancati has shown that, besides with blood-serum, the reaction can be obtained with the fluid from blisters, with milk or tears, taken from a person suffering from the disease, but less markedly with serous fluids and urine, and still less so with aqueous humour, œdematous fluid or bile, whilst with saliva it fails altogether.

The only extra apparatus required for doing the test are four or five glass staining dishes (black for infective matter and white for non-infective), or, if preferred, watch-glasses or hollow slides may be used; one or two lancet-pointed needles to puncture the skin, as wounds made with these are less painful and yield more blood than those made with ordinary sewing needles. It is also necessary to have one or two fine capillary pipettes to collect the blood. Capillary vaccine tubes are sometimes used, but they are too small in the bore to allow of separation of the blood-clot, though glass tubes having a bore two or three times larger than

these are perfectly suitable for the purpose. For the actual test we must be provided with :

1. An active culture of *B. typhosus*.
2. Sterile nutrient broth.
3. Blood from an enteric patient.

1. *The Typhoid Culture.*—This can generally be obtained by sending a couple of sterilized agar tubes to the physician in charge of one of the larger fever hospitals, requesting him to inoculate them from a *good strain* of typhoid culture, and return. When received, they should be labelled "Stock *B. typhosus*," dated, and incubated for twenty-four to thirty hours at 37° C., in order to obtain a good growth, then removed and preserved in a cool place and preferably under lock and key. Little or no farther growth will then take place, but the culture will remain alive and active for a long period. It is advisable, however, to make a subculture on agar every four weeks, in order to retain a reliable stock. By this means we can keep active cultures for years, though it is as well to renew the stock from a good source from time to time.

2. *Sterile nutrient broth* can be made at home or purchased from any reliable maker in quarter or half litre flasks, and run into tubes and resterilized. They can then be kept for a long period.

3. *Blood-Serum.*—This is easiest obtained from the lobe of the ear, after first rendering the part aseptic and at the same time hyperæmic, by rubbing the part briskly with a piece of cotton-wool soaked in a 3 or 4 per cent. solution of lysol. The skin is then washed with a little methylated spirit, dried, and a sharp stab given with the sterilized needle. A large drop of blood generally exudes, as much as possible of which is to be drawn up into the sterilized pipette or tube, the ends sealed in a flame, and placed vertically until the clot and serum are separated.

In pricking the lobe of the ear, avoid sending the needle *through* the part into your own finger. If not careful, this is easily done.

The Test.—1. Inoculate a tube of sterile broth with a sterilized

platinum wire loopful of typhoid culture from the "stock" agar tube. Incubate this at 37° C. for fourteen or sixteen hours. If the tube is inoculated the last thing at night, it will be ready for using in the morning; but the broth culture must never be over twenty-four hours old, and if in any doubt as to its activity, it is as well to first examine a drop of the broth with the microscope, in order to be certain that the bacilli are living and actively motile.

2. Break the ends off the blood-serum tube, and blow the contents into a watchglass or the trough of a hollow slide, using if desired, a small rubber ball which can be obtained for this purpose. If done carefully, the blood-clot can be kept separate from the clear serum.

3. Pour out a little *sterile broth* into a white staining dish.

4. Measure on to a slide or watchglass with the platinum wire loop one loopful of the clear *blood-serum* and nine loopfuls of *sterile broth*, and mix. Sterilize the wire. This gives a dilution of 1 in 10.

5. Into a black staining dish pour a little of the *typhoid broth culture.*

6. On a clean cover-slip, held in the forceps, measure equal quantities (say five loopfuls) of the *diluted serum* (4) and the typhoid *broth culture* (5), and mix. Flame the loop.

This now gives a dilution of the serum of 1 in 20, which dilution may be worked with, although a higher one is to be recommended. To get a dilution of 1 in 30, mix two parts (say six loopfuls) of the *broth culture* (5) with one part (say three loopfuls) of the *diluted serum* (4), or, if preferred, make the original dilution of the serum (4) 1 in 15, and then, by taking equal quantities of this mixture and the broth culture (5), we get the desired dilution.

A small metal pen-rack is useful for resting the needle on in operations of this nature, where so many different liquids are being used.

7. Place the cover-slip drop-side downwards on a slide provided with a ring of vaseline or paraffin, or, if preferred, the final dilution can be made on the slide, and the cover-slip lowered on

to it in the ordinary way; but if it is desired to watch the organisms for any length of time, the former method is the better, as the ring of vaseline makes an air-tight joint and prevents the mount from drying up, which usually takes place within an hour if the ordinary mounting method is adopted.

8. Label the slide, but avoid using the tongue, as we are dealing with an infective living organism; mark it "1 to 30," and with the exact time of mounting.

9. Examine at once with the oil immersion lens. When examining stained specimens we require the iris diaphragm of the microscope wide open, and use the plane mirror; but for unstained organisms, as in this case, the diaphragm must be almost closed, in order to bring out the shadows, which are caused by the different refractive powers of the bacilli and the liquid. Artificial light, such as the Welsbach incandescent gas, is preferable to daylight for illumination.

II.

BACTERIOLOGICAL NOTES FROM FOREIGN JOURNALS.

Report on Diphtheria Bacilli in Well Persons, by a Committee of Massachusetts Association of Boards of Health.—This committee, composed of a considerable number of bacteriologists of high reputation, have presented recently a report upon the extremely significant topic suggested in the title. The fact that diphtheria bacilli may be found in the throats of perfectly healthy persons is clearly a matter of the utmost importance in relation to the problem of isolation of patients, and the report of this committee is of the greatest value in its relation to the methods of procedure adopted by Boards of Health. The conclusions reached are briefly as follows: Diphtheria bacilli are frequently found in the throats of perfectly healthy persons, the percentage varying according to the different observers, largely because different bacteriologists use different criteria for determining this bacillus. The percentage given ranged all the way from 1·2 per cent. to 22 per cent., or even more. These instances are found among well people, scattered

in general among the public, but are naturally more abundant among members of families in which there are cases of diphtheria. Of the former it is estimated, according to the percentage, that there must be at least 8,000 persons in the city of Boston harbouring bacilli in their throats. The conclusion reached by the committee is that it is quite impracticable to isolate such persons if they are not known to have been recently exposed to the disease. The presence of persons with bacilli in their throats in the families that have cases of diphtheria is naturally considerably higher. The committee, however, after careful consideration of the matter, conclude also that it is not advisable, as a matter of routine, to isolate all well persons in infected families, schools, or institutions. One member of the committee differs from this to a slight extent. The importance of these conclusions in determining the rules for quarantine adopted by Health Boards is very manifest. The rest of the paper, which is a rather lengthy one, is devoted to the bacteriological study of the types of bacteria which come under the general group of diphtheria organisms. The authors describe seven types of bacilli which in general may be found grouped together, of which the first three only are regarded as typical virulent diphtheria bacilli. The report is reprinted from the *Journal of the Massachusetts Association of Boards of Health*, July, 1902, and is one that should be thoroughly studied by all interested in the problems of public health.

A SUCCESSFUL ATTEMPT TO CULTIVATE THE "BACILLUS LEPRÆ." VAN HOUTEN. (*Journ. of Path. and Bac.*, 8; 260, 1902.)—Although many attempts to cultivate the leprosy bacillus have given apparently positive results, the author of this paper is inclined to doubt whether any of them are sure enough to leave it certain that the bacillus has actually been cultivated. He adopts a somewhat new method of study, and is confident that he has succeeded in obtaining pure cultures of the bacillus. His method is to inoculate broth with leprous material, and for this purpose he finds that the best success is obtained by a mixture of fish broth and beef broth, which must be slightly alkaline. In such a broth the bacilli grow readily, many of them showing

motility. From such a broth he is able to obtain subcultures in a similar mixture, and, after several cultivations, subcultures can be obtained in beef broth. The pure cultures agree in morphological characters with the leprous bacillus, but the chief evidence that he has succeeded in his work is obtained by the action of the leprous serum upon cultures of the organism. These bacilli, when mixed with diluted human serum, show the Pfeiffer-Bordet reaction. This reaction, which destroys the bacilli, occurs both with ordinary serum and with leprous serum, but the reaction is much more marked with leper serum than with the ordinary human serum, from which he concludes that his organism is the specific agent of leprosy.

KASPEREK. (*Cent. f. Bac. u. Par. O.*, 13; 383, 1902.)—Dr. Kasperek has described a very ingenious funnel devised for the purpose of filtering gelatine or agar that needs to be kept warm during filtering. The piece of apparatus consists of an ordinary glass funnel, in which are placed several layers of asbestos paper, fastened together with water glass, the asbestos paper conforming to the shape of the filter. Between the layers of the asbestos there are wound about 3 metres of a ·3 millimetre nickel wire, so wound around that the different coils are thoroughly isolated from each other. The two ends of the wire are connected with binding screws. To one of the binding screws is attached an electric wire from an electric current, and to the other a wire that is arranged to pass through a series of ordinary incandescent lights. By connecting the wires with the electric current and turning on a single light, the filter is warmed to a temperature of 42°. By connecting with two lights of similar power the filter is warmed to 60°, and by the addition of a third light of 16 candle-power a temperature of 70° can be obtained. This filter is used in the ordinary way, and is extremely convenient for filtering material that needs to be kept warm.

UEBER NEUERE NÄHRBODEN ZUR ZÜCHTUNG DES TUBERCULOSEERREGER'S, ETC. JOCHMANN. (*Hyg. Rund.*, p. 969, 1900.)—This author has found that a medium with an acid reaction has

a favourable effect upon the growth of the tubercle bacilli. The most vigorous development is obtained from the blood serum of sheep, cattle, and man, to which lactic acid had been added in the proportion of 10 drops of a 1 per cent. solution to 50 c.c. of the serum. The above serum should give a neutral reaction with the litmus before the lactic acid is added.

Ueber die Abtödtung der Tuberkelbacillen bei Wärme. Bang. (*Zeit. f. Thiermed.*, 7; 81, 1902.)—Bang has contributed a series of careful experiments to the question as to the temperature at which the tubercle bacilli in milk are rendeerd innocuous. The claim made by Smith some years ago that tuberculous milk, heated for a time to 60° C. in such a way to avoid the formation of the scum, is made incapable of producing tuberculosis, has been strongly contested. The very high rank of Professor Bang makes it especially interesting to find that he confirms Smith's observation practically *in toto*. He finds that milk in closed tubes, heated to 60° C. for five minutes, if inoculated produces tuberculosis, but to a moderate extent; if heated for fifteen minutes, the effect is very much reduced. Milk heated to 65° for five minutes is rendered entirely innocuous, and the same result follows heating at 75°, 80°, and 85°. He found, however, that milk heated for two minutes at 60° gave only negative results when this milk was used in feeding experiments, thus confirming the conclusion reached by Smith that a temperature of 60° for a comparatively few minutes is quite sufficient to render milk incapable of producing tuberculosis when it is subsequently used as food.

A series of experiments on the same subject has been described by Hesse in *Zeit. f. Thiermed.*, p. 321, 1902, and the results were practically identical, showing that a heating to 60° for twenty minutes renders the milk harmless, not only so far as concerns tuberculosis, but also in destroying the infectious agency of cholera, typhoid, and diphtheria.

CHEMICAL NOTES.

Composition of Cow's Milk. H. C. Sherman. (*Journ. Amer. Chem. Soc.*, 1903, 25, [2], 132.)—Samples were taken at all times of year from the same herd of about 600 cows.

The author finds that the percentage of protein (percentage of nitrogen found by Kjeldahl's method × 6·25) and the percentage of fat vary according to the season, being lower in spring and summer than in autumn and winter, while the percentage of lactose remains practically constant throughout the year.

Generally speaking, it was found that the amount of protein varies with the amount of fat, and that, taking the average milk, the relation is approximately that expressed by Timpe (*Chem. Zeit.*, 23, 1040)—viz., protein = 2 + 0·35 fat. It was also found that deficiency in solids not fat is usually, as stated by Richmond, due to small amount of lactose, whilst any excess over 9 per cent. is generally largely due to protein.

Richmond's statement that the relation between protein and ash (ash = 0·36 + 0·10 protein) was found to apply very nearly, the author's results approximating more closely to the relation: ash = 0·38 + 0·1 protein.

A New Concentrated Article of Food. M. Woolf, London. (*Eng. Pat.*, 7,919, April 4, 1902.)—From 65 to 85 lb. of sugar are dissolved in water to make a concentrated solution. This is mixed with a solution of 9 to 12 lb. of gelatin in 3 to 6 gallons of fruit-juice. The whites from 85 to 100 eggs are then added, and the mixture formed into tablets.

Absorption of Ammonia by Sea-Water. J. Thoulet. (*Comptes rend.*, 136, [7], 477-478.)—The free and albuminoid ammonia in certain samples of sea-water from the Mediterranean and the North Atlantic were found to be higher after filtration through a paper filter than before. Experiments in which these waters and also distilled water were filtered through paper and glass wool-filters which had been exposed to the ordinary atmosphere, and to one rendered artificially ammoniacal, and in which they were poured drop by drop from one vessel to another through the

ammoniacal atmosphere, showed that the effect was due to ammonia which the filters had absorbed, and which they yielded again to the liquid. Sea-water appeared to absorb ammonia in this way more readily than distilled water. When two successive quantities of water were passed through the same filter, the free ammonia was raised in the first case from 0·04 to 0·33 milligramme per litre, and in the second case from 0·04 to 0·05, showing that the whole of the ammonia was rapidly washed out of the filter. Hyaline quartz in grains of about 0·5 millimetres diameter, recently ignited, did not remove any of the ammonia from a sea-water containing 0·75 milligrammes per litre, when it was filtered through it.

COLORIMETRIC PROCESS FOR THE DETECTION AND DETERMINATION OF BORIC ACID. C. E. CASSAL and H. GERRANS. (*British Food Journ.*, October, 1902; *Chem. News*, 1903, 87, [2,251], 27-28.)—If a solution containing boric acid be treated with curcumin—or ordinary turmeric—and oxalic acid, and the mixture evaporated to dryness on the water-bath, an intense magenta-red colour is produced, different from the "rose-red" colour obtained in the ordinary turmeric test for boric acid. The reaction is much more delicate than the old test, and the colour is practically permanent for ten or twelve hours, but fades very gradually on long keeping. The colouring matter is readily soluble in alcohol and ether, but is destroyed by the addition of water in excess. With alkali it gives an intense blue coloration. In applying the test for the detection of boric acid in milk and other food products, the ash of the substance, which, if it contain only a very small amount of boric acid, is rendered alkaline with barium hydroxide solution previous to evaporation and incineration, is treated with a few drops of (1) dilute hydrochloric acid, (2) saturated solution of oxalic acid, and (3) alcoholic solution of curcumin or turmeric. The mixture is dried on the water-bath, and the residue is extracted with alcohol. Compounds of potassium and sodium in large amounts interfere with the reaction. For the determination of boric acid, for example, in milk, 15 to 20 grammes of the sample are made strongly alkaline

with barium hydroxide solution, and the mixture evaporated to dryness in a platinum dish at a temperature of about 105° C. The residue is well charred, broken up, made slightly acid with hydrochloric acid, and exhausted with successive small quantities of hot water, the extracts being filtered into a 100 c.c. flask. The filter-paper and its contents are made alkaline in a platinum dish with barium hydroxide solution, the mixture evaporated to dryness, and the residue heated carefully till practically the whole of the carbon has disappeared. The ash is treated with a small quantity of 25 per cent. hydrochloric acid, the solution and washings added to the main extract, and the whole made up to 100 c.c. Ten c.c. of this solution are poured over 10 to 15 grammes of purified sand (obtained by igniting "silver sand," boiling it with 25 per cent. hydrochloric acid, and thoroughly washing and drying) in a porcelain dish, the mixture is made alkaline with barium hydroxide solution, and evaporated to dryness with occasional stirring. The dry mass is made slightly acid with 25 per cent. hydrochloric acid, 2 c.c. of a saturated solution of oxalic acid and 2 c.c. of an alcoholic solution of curcumin (1 gramme per litre) are added, and the mixture well stirred. The dish is now covered with a funnel, the stem of which is connected to a set of "potash bulbs" containing barium hydroxide solution, the bulbs being placed in a beaker containing cold water. The mixture is then evaporated to dryness, a gentle current of air being aspirated through the apparatus. An additional 1 c.c. of the curcumin solution is well mixed with the dry mass, and the mixture again dried. The colouring matter formed is extracted with successive quantities of methylated spirit and the extracts filtered. The liquid in the potash bulbs is now mixed with the sand in the dish, made alkaline, if necessary, with barium hydroxide solution, and evaporated to dryness. The dry mass is treated as before with hydrochloric acid and the oxalic acid and curcumin solutions, and the processes of evaporation and alcoholic extraction repeated, the solution of the colouring matter being added to that previously obtained. A standard colour solution is prepared by treating 10 c.c. of a solution of boric acid of known strength (1 c.c. = 0·1

milligramme of B_2O_3) in an exactly similar manner, the solution of the colouring matter being made up to 200 c.c.

DETERMINATION OF ATMOSPHERIC CARBON DIOXIDE BY THE WALKER METHOD. A. G. WOODMAN. (*Journ. Amer. Chem. Soc.*, 1903, 25, [2], 150.)—The author describes a series of experiments carried out to ascertain the most suitable conditions for working the Walker method for estimating carbon dioxide in air (see *Journ. Chem. Soc.*, 1900, 77, 1,100).

The method consists of allowing a definite volume of air (usually 1 to 2 litres) to come in contact with a known weight of barium hydroxide in solution; the liquid is now filtered under reduced pressure, and the amount of barium hydroxide in the filtrate estimated by titration with a standard solution of hydrochloric acid.

The author finds $\frac{N}{100}$ barium hydroxide solution and $\frac{N}{50}$ hydrochloric acid the most convenient to use. The vessels for absorption were coated with a layer of barium carbonate.

Thirty minutes was found a convenient time for absorption, no advantage appearing as the result of longer contact.

The author also suggests slight modifications of the apparatus used by Walker.

He concludes, as the result of his work, that Walker's method is accurate to 0·1 part in 10,000, but with careful work he considers that this error should certainly be as low as 0·03 part.

He finds the method rapid, easy of execution, and preferable to the Pettenkofer method.

SOME NEW PROPERTIES OF UREA. W. RAMSDEN. (*Proc. of the Physiol. Soc.*, pp. xxiii-xxvi, 1902.)—A series of experiments on the action of urea on proteid substances has brought to light a number of hitherto unknown facts, some of which have important bearings on general laboratory technique. The following are some of the more important results. The presence of urea up to saturation prevents the coagulation by heat of all proteid solutions examined. Globulin, caseinogen, acid, and alkali-albumin, copper albuminate, and even heat-coagulated proteids, swell up and dissolve in a saturated aqueous solution of urea. Dry gelatin is

dissolved at room temperature until 40 per cent. is in solution. Coagulable proteids are converted at room temperature into a substance possessing all the properties of alkali and acid-albumin according as the action of the original proteid solution was alkaline or acid. Urea has a marked accelerating effect, greater as the amount increases up to about 10 per cent., upon the digestion of fibrin by pepsin, HCl (·3 per cent. HCl), or by trypsin. In much larger quantities it has a retarding influence. "A dead frog placed in saturated urea solution becomes translucent and falls to pieces in a few hours. The ligaments, tendons, and connective tissue throughout the body are converted into a clear, soft jelly. The muscles, if shaken briskly in water, fall completely into individual muscle fibres, which retain their structural features and make admirable histological preparations. The cornea swells up and becomes soft, the lens is extruded from the eye on slight pressure. The hæmoglobin of the blood is converted into a body giving the spectrum of alkaline hæmatin, and which, on reduction with ammonium sulphide, gives the spectrum of hæmochromogen. The skin brushes away with the slightest touch. Nervous tissues become semi-transparent, and the nerves readily rupture. Connective tissues of different animals are differently affected. In a saturated urea solution no putrefaction ever takes place." This action of urea on connective tissue makes it a valuable histological reagent for the separation of a tissue into its individual elements (*e.g.*, cardiac and skeletal muscle-fibres, fat cells, etc.). The tissues can be preserved ndefinitely in the saturated urea solution, and only require transference to water for a short time to become stainable by the ordinary methods.

Various compounds of urea with fatty acids were studied. Further investigations regarding the reasons for and method of the influence of urea on proteids are being carried on by the author.

THE ROYAL INSTITUTE OF PUBLIC HEALTH.

A MEETING of the Council of The Royal Institute of Public Health was held at 19, Bloomsbury Square, W.C., on Wednesday, April 22, at 4 p.m., the President of the Institute in the chair.

Letters of regret at their inability to attend were read from Dr. Anningson, Dr. Johnston, Sir James Russell, and Dr. Usher.

The Treasurer reported that the balance at the bank, after the payment of all liabilities, was £292.

A letter was read from Morris Hayes, Esq., C.A., Honorary Auditor—(*a*) reporting that he had examined the accounts of the Institute for the past year; (*b*) enclosing the balance-sheets, which were ordered to be printed; and (*c*) making certain suggestions relative to the accounts, which the Council approved.

A cordial vote of thanks was accorded to Mr. Morris Hayes for his services, and the Council *resolved* to recommend the Annual Meeting of Fellows and Members to elect him an Honorary Member of the Institute.

A letter was read from Professor Ferdinand Hüppe, M.D., of the University of Prague, intimating that it would be convenient to him to give the Harben Lectures in October next, and directions were given that arrangements should be made accordingly.

It was *resolved* that the Executive Committee be empowered to appoint correspondents both in France and Germany, to make monthly contributions to the *Journal of State Medicine* of abstracts of papers and reports published in those countries of Public Health matters.

The following gentlemen were appointed on behalf of the Institute as Delegates to the eleventh International Congress of Hygiene and Demography, to be held at Brussels in September next:

As Delegates :

The President of the Royal Institute.

SAMUEL AGNEW, Esq., M.D., Medical Officer of Health, Lurgan.

Bushell Anningson, Esq., M.D., Medical Officer of Health, Cambridge.
E. G. Annis, Esq., Medical Officer of Health, Greenwich.
F. Drew Harris, Esq., M.B., Medical Officer of Health, St. Helens.
Professor Antony Roche, M.D., of Dublin.
E. H. Snell, Esq., M.D., Medical Officer of Health, Coventry.
Professor R. C. R. Tichborne, of Dublin.
Henry Whitaker, Esq., M.D., Medical Officer of Health, Belfast.
W. T. G. Woodforde, Esq., M.D., Medical Officer of Health for Berkshire.

On the motion of the President, a cordial vote of thanks for his services was accorded to Sir James R. A. Clark, Bart., C.B., who had resigned his offices of Trustee and Registrar.

The following gentlemen were elected:

As Fellows:

William Benton, L.R.C.P. Lond., D.P.H., Conjoint Board Irel.
Arthur Briggs Dunne, M.B., D.P.H., City Hospital, Sark Hill, Dingle, Liverpool.
Surgeon-General George Joseph Hamilton Evatt, M.D., P.M.O., 2nd Army Corps, Salisbury.
John Sinclair Holden, M.D., Medical Officer of Health, Sudbury, Suffolk.

As Members:

Hon. Captain James Morrison, Civil Surgeon, Buldana, Berans, India.
Thomas Bradley, Clerk to the St. Anne's-by-the-Sea Urban District Council.

Associate:

John Henry Brass, Member of the Metropolitan Asylums and Water Boards.

(*Signed*) James Cantlie,
Hon. Secretary.

THE ROYAL INSTITUTE OF PUBLIC HEALTH.

BALANCE SHEET, December 31, 1902.

Dr. LIABILITIES.

	£ s. d.	£ s. d.
To Sundry creditors		20 17 11
Subscriptions paid in advance		34 13 0
Life membership fees		63 0 0
Rent paid in advance		12 10 0
Reserve Fund—		
To meet depreciation of lease		36 0 0
Accumulated fund—		
As per last balance sheet ...	1,972 16 2	
Add excess of income over expenditure for year ended 31st December, 1902, as per account	716 17 2	
		2,689 13 4
		£2,856 14 3

ASSETS. *Cr.*

	£ s. d.	£ s. d.
By Cash—		
At Bank of England	106 16 2	
In Secretary's hands	1 9 4	
		108 5 6
Postmaster-General—		
Deposit *re* telephone calls		1 0 0
Investments—		
£800 India 3 per cent. stock (at cost)	885 12 0	
Woolwich Equitable Building Society 3 "B" subscription shares of nominal value of £30 each (amount paid)	36 0 0	
		921 12 0
Loan—		
Sanitary Inspectors' Examination Board (amount advanced)		30 5 0
Sundry debtors		229 11 9
Furniture and fittings—		
As per last balance sheet ...	193 0 0	
Further purchases	47 5 0	
	240 5 0	
Less amount written off for depreciation (10 per cent.) ...	24 5 0	
		216 0 0
Property—		
Leasehold interest in premises, No. 19, Bloomsbury Square. Purchase money		1,350 0 0
		£2,856 14 3

I hereby certify that all my requirements as Auditor have been complied with, and, after examination of the accounts and books with the vouchers, report that the above balance sheet is properly drawn up so as to exhibit a true and correct view of the state of the Institutes affairs as shown by the books. I have also compared the balance at the bankers with their certificate, have verified the investments, and inspected the lease and documents connected therewith.

(*Signed*) MORRIS HEYES, Chartered Accountant,
Hon. Auditor.

April 3, 1903.

THE ROYAL INSTITUTE OF PUBLIC HEALTH.

INCOME AND EXPENDITURE ACCOUNT

FOR THE YEAR ENDED DECEMBER 31, 1902.

Dr.

Year 1901. £ s. d.	EXPENDITURE.	£ s. d.	£ s. d.
	To Management expenses—		
125 18 0	Salary and commission of secretary	108 13 3	
5 5 0	Audit fee		
90 6 0½	Printing, stationery, and advertising	67 19 10	
39 6 4	Postages, telephoning, and telegrams	36 7 8½	
41 14 0½	Cleaning, heating, and lighting offices, travelling, and sundry expenses	67 7 9½	
2 3 10	Bank charges	1 18 10	
48 1 2	Alterations and repairs to property...	25 10 11	
352 14 5			307 18 4
	Rent, rates, and taxes—		
112 10 0	Ground rent	90 0 0	
13 0 2	Rates and taxes	16 1 0	
125 10 2			106 1 0
35 1 4	Interest on mortgage		10 3 1
309 1 3	Expenses of printing journal, deducting receipts from advertisements and sales		241 8 11
28 7 0	Annual dinner net cost (1901)		
21 19 3	Depreciation on furniture		24 5 0
18 0 0	Reserve to meet depreciation of lease ...		18 0 0
890 13 5			707 16 4
477 7 7	Balance carried to accumulated fund, being excess of income over expenditure for the year		716 17 2
£1,368 1 0			£1,424 13 6

Cr.

INCOME.	£ s. d.	Year 1901. £ s. d.
By Subscriptions...	1,053 15 9	1,043 13 3
Sundry donations	1 11 6	181 11 6
Rent of offices	245 0 0	112 10 0
Interest on investments	24 6 3	30 6 3
Harben Trustees' Contribution towards the expenses incurred in connection with the "Harben" lectures, and generally for the advancement of the science of "Public Health"...	100 0 0	
	£1,424 13 6	£1,368 1 0

JOURNAL ACCOUNT

Dr. FOR THE YEAR ENDED DECEMBER 31, 1902. *Cr.*

Year 1901. £ s. d.		£ s. d.		£ s. d.	£ s. d.	Year 1901. £ s. d.
425 1 2	To Printing journal, postages, envelopes, addressing, etc.	381 14 4	By Advertisements, less commission …	136 6 3		115 2 3
20 0 0	Fees for chemical notes … …	9 3 4	Sales, less commission	13 2 6		20 17 8
					149 8 9	
			Balance carried to income and expenditure account … …		241 8 11	309 1 3
£445 1 2		£390 17 8			£390 17 8	£445 1 2

HARBEN TRUST ACCOUNT

FOR THE YEAR ENDED DECEMBER 31, 1902.

Dr. EXPENDITURE. INCOME. *Cr.*

	£ s. d.		£ s. d.
To Gold Medal … … … … … …	52 10 0	By interest and dividends on eighty £5 fully paid-up shares in the Prudential Insurance Company (Income Tax paid by Company) … … …	192 0 0
Lecturer's Fee … … … … …	52 10 0	Income Tax refunded by Commissioners of Inland Revenue (three years to April 5, 1902) … …	21 0 9
Royal Institute of Public Health, contribution towards expenses incurred in connection with the Harben Lectures and generally for the advancement of The Science of Public Health … …	100 0 0		
	205 0 0		
Balance carried down, being excess of income over expenditure for the year 1902 … … …	8 0 9		
	£213 0 9		£213 0 9

	£ s. d.
By balance in hand, January 1, 1902 … … … … …	117 13 6
Balance brought down, being excess of income over expenditure for the year 1902 … … … … … … …	8 0 9
Bank of England, balance in their hands, December 31, 1902 …	£125 14 3

March 20, 1903. (*Signed*) M. HEYES.

THE ROYAL INSTITUTE OF PUBLIC HEALTH.

LIVERPOOL CONGRESS.

July 15 to *July* 21, 1903.

IN UNIVERSITY COLLEGE, LIVERPOOL.

President.

THE RIGHT HON. THE EARL OF DERBY, K.G., G.C.B.

Vice-President and Chairman of the Executive Committee.

THE RIGHT HON. THE LORD MAYOR OF LIVERPOOL.

SECTION A.

PREVENTIVE MEDICINE AND VITAL STATISTICS.

Hon. Secs.: A. A. Mussen, Esq., M.D., Health Offices, Liverpool.
H. S. Willson, Esq., M.A., M.B., King's College, London.

SECTION B.

BACTERIOLOGY AND COMPARATIVE PATHOLOGY.

President: Professor Rubert W. Boyce, M.B., F.R.S.
Hon. Secs.: R. T. Hewlett, Esq., M.D., King's College, London.
H. E. Annett, Esq., M.D., University College, Liverpool.

SECTION C.

TROPICAL SANITATION.

President: Professor Nocht, Hamburg.
Hon. Secs.: James Cantlie, Esq., M.A., M.B., London.
J. W. W. Stephens, Esq., M.A., M.D., Liverpool.

SECTION D.

CHILD STUDY AND SCHOOL HEALTH.

President: Professor C. S. Sherrington, M.D., F.R.S.
Hon. Sec.: J. Hay, Esq., M.B.

SECTION E.

PORT SANITARY ADMINISTRATION.

President: Alderman Thomas Clarke, M.D., J.P.
Hon. Secs.: J. Wright Mason, Esq., M.B., Hull.
W. Hanna, Esq., M.B., Port Sanitary Offices, Liverpool.

SECTION F.

Sanitation of Congested Areas and Rehousing the Dispossessed.

President: Austin Taylor, Esq., M.P.
Hon. Sec.: F. T. Turton, Esq., Surveyor's Department, Liverpool.

SECTION G.

Municipal and Parliamentary.

President: Sir John Brunner, Bart., M.P.
Hon. Sec.: E. W. Pierce, Esq., Municipal Offices, Liverpool.

SECTION H.

Engineering.

President: George Frederick Deacon, Esq.
Hon. Sec.: J. Brodie, Esq., City Engineer, Liverpool.

Hon. Secretary to the Congress: E. W. Hope, Esq., M.D., D.Sc.

On Sunday, July 19, the Sermon to the Congress will be preached by the Right Rev. the Lord Bishop of Liverpool, D.D.

THE ROYAL ARMY MEDICAL CORPS IN INDIA.

The Government of India has sanctioned new and improved arrangements of pay of the officers of the Royal Army Medical Corps serving in India, which have effect from November, 1902.

The pay of Lieutenant-Colonels and selected Lieutenant-Colonels is raised to 1,150 rupees and 1,250 rupees per mensem respectively. Captains of over ten years' service will receive 650 rupees, over seven years' service 530 rupees, and below seven years 475 rupees, per mensem. Lieutenants will draw pay, 420 rupees per mensem. A charge allowance will be paid to the senior medical officer in charge of a hospital, the rates being: in the case of 300 or more beds, 240 rupees; of 200 or more beds, 180 rupees; of 100 or more beds, 120 rupees; and of 50 or more beds, 60 rupees—monthly. Specialists' pay at the rate of 60 rupees monthly will also be granted to officers below the rank of Lieutenant-Colonel, who may be appointed to posts entitling them to this pay.

LEGAL NOTES.

CHAPMAN *v.* THE GILLINGHAM URBAN DISTRICT COUNCIL.

Early in December, 1901, a case of small-pox occurred in New Brompton, a town of 19,000 inhabitants, adjoining Chatham and Rochester, within the sanitary authority of the defendant Council, who availed themselves of an offer of an unused stable, a mile away from the town, in which the first patient and two subsequent cases were temporarily accommodated. The plaintiff's house was situated 200 yards away from the stable. One of the plaintiff's children developed symptoms of small-pox thirteen days after the first patient's arrival in the stable; two days later the child was seen by a medical man, and the illness notified three days after that. Five other members of the family contracted the disease, and four of them died. The plaintiff sued the defendant Council for injuries done to him and his household by the introduction of small-pox, and claimed damages. He alleged negligence in the choice of the site, which, however, complied with the Local Government Board Regulations, and in the management of the temporary shelter, but with the Judge's permission the claim was so amended as to include the larger issue, that the bringing of a small-pox case into the neighbourhood of the plaintiff constituted a nuisance. For the defence it was urged that there had been no negligence, and that they had acted under their statutory powers.

In 1881 (in the case of Hill *v.* Metropolitan Asylums Board), Lord Blackburn ruled that a small-pox hospital so conducted as to spread infection to persons on adjoining property is a nuisance, and the result of the several cases in which this question has been raised since then is that a small-pox hospital, if properly conducted, does not cause appreciable danger to the public.

In the Gillingham case it was held that the Sanitary Authority had created a nuisance in a sparsely populated area by removing to it a case of small-pox which had had its origin in a densely populated part of the town, and had itself, or by its agents, failed to employ reasonable care in the management of the temporary isolation shelter, and the Council was therefore mulcted in damages.

This case, however, serves to bring to light the very difficult position in which Sanitary Authorities throughout the country are in regard to the provision of isolation hospitals for infectious diseases, and for the removal of cases to them. There is no statutory obligation on Sanitary Authorities to provide hospitals, or to concern themselves with the removal of infectious cases to existing isolation hospitals. The path of safety would appear to lie for them in ignominious idleness. If they build hospitals for infectious diseases, and if by the removal of cases of small-pox to these hospitals they prevent the spread of the disease in their district, they may be made liable for damages; whilst if they do nothing, if they allow cases to remain in the heart of congested areas, spreading infection and death on every side, they incur no penalty at law—only the stigma of neglected duty rests upon them. Surely, then, it is time to impose upon all Sanitary Authorities a statutory obligation to do these things, at the same time conferring upon them a statutory immunity in respect of all acts done with reasonable care and without negligence.

KING'S BENCH DIVISION.

WEST RIDING OF YORKSHIRE RIVERS BOARD *v.* GAUNT AND SONS.

The Court, the Lord Chief Justice, and Justices Wills and Channell, held that a natural stream or water-course may cease to be a stream or water-course, and may

become a sewer into which certain persons may acquire certain rights of drainage, under section 21 of the Public Health Act, 1875, and Local Acts, and the fact that the sewer discharges into a water-course does not deprive them of their rights. But the mere fact that sewage has been discharged for a number of years into a water-course so that the water-course has become polluted is not of itself sufficient to turn the water-course into a sewer. The case was remitted for a new trial, at which the evidence should be directed to show whether the channel at the point at which the respondents discharge their effluents has by the lawful operations of the Sanitary Authority become a sewer into which the respondents have a right to discharge.

HUMPHREY *v.* YOUNG.

By the Court, the Lord Chief Justice, and Justices Wills and Channell. In each case it is a question of fact as to whether a pair of semi-detached houses is to be regarded as one building or more. Travis *v.* Uttley and Hedly *v.* Webb cited.

FAIRBRASS *v.* CANTERBURY CORPORATION.

By the Court, the Lord Chief Justice, and Justices Wills and Channell. Section 157 Public Health Act, 1875, gives the Local Authority power to make by-laws with reference to pulling down buildings, the provisions of which were not intended to be confined to cases fulfilling the requirements of section 158.

PUBLIC HEALTH MEDICAL APPOINTMENTS.

BLAKISTON, Arthur Alexander, M.R.C.S., Medical Officer of Health for Glastonbury.
JOHNSON, James, L.R.C.S. Edin., Medical Officer of Health, Bispham and Norbreek, Poulton-le-Fylde.
SLADER, George, M.R.C.S., Medical Officer of Health, Gainsborough Rural District Council.
TOLIN, James, M.D., R.U.I., Medical Officer of Health, Ilkeston Town Council.

DIPLOMAS IN PUBLIC HEALTH.

University of Aberdeen.—William John Ironside Bruce, M.B., Ch.B.; Hugh Allan Davidson, M.B., Ch.B.; Andrew Hosie, M.D.; David Albert Hutcheson, M.B., Ch.B.; George Nicol Wilson, M.B., C.M.

Trinity College, Dublin.—Part I.: George Raymond, M.B., B.Ch.; Thomas Gillman Moorhead, M.D.; Kingsmill Jones, M.B., B.Ch.; Albert Lancelot Hoops, M.B., B.Ch.; Walter Charles Oram, M.B., B.Ch.; John Newson Laird, M.B., B.Ch.; Robert George Hetherington Tate, M.B., B.Ch.; Thomas Fletcher Telford, M.B., B.Ch. Part II.: Albert Lancelot Hoops, M.B., B.Ch.; Francis William Lamb, M.B., B.Ch.; Kingsmill Jones, M.B., B.Ch.; John Newson Laird, M.B., B.Ch.

University of Cambridge.—Alfred Armer, M.B.; Edward Collins Bousfield, L.R.C.P.; John Francis D'Abreu, L.R.C.P. Edin.; Arthur Burness Dalgetty, M.D. Aberd.; John Donald, M.D. Glasg.; Andrew Milroy Fleming, C.M.G., M.B., C.M.; Friedrich Gröne, M.R.C.S.; George William Jenney, M.B.; Harry Malcolm Mackenzie, M.B.; Sydney Gwenffrwd Mostyn, M.A., M.B.; Edward William Reese-Jones, M.B. Glasg.; George Ernest Richmond, M.B. Lond.; Henry Buckley Roderick, M.A., M.D. (Emm.); James Sandison, M.R.C.S.; David Sommerville, M.D.; Archibald Campbell Stevenson, M.B.; Gerard Charles Taylor, M.D. (Christ's); Francis Peter Vieyra, M.R.C.S.; Alfred Ernest Walker, M.R.C.S.

BOOKS, JOURNALS, REPORTS, ETC., RECEIVED.

The Lancet; The British Medical Journal; The Sanitary Record; The Surveyor; The Medical Times and Hospital Gazette; The Medical Review; The Pharmaceutical Journal; The Councillor and Guardian; Albany Medical Annals; The Glasgow Medical Journal; Public Health; The Journal of Applied Microscopy; The Journal of the Society of Chemical Industry; Egésyég; La Presse Medicale; La Salute Pubblica; The Journal of Tropical Medicine; The Caledonian Medical Journal; The Public Health Engineer.

Also the following Reports:

Royal Commission on Sewage Disposal; Annual Report Stewartry of Kirkcudbright, Borough of Middleton, City and County of Exeter, Borough of Southend-on-Sea; London County Council Examination of the Atmosphere of the Central London Railway; Cancer in Ireland; The Proceedings of the Royal Society of Edinburgh.

Letters, Notes, Queries, etc.

Communications respecting Editorial matters should be addressed to "THE EDITOR, JOURNAL OF STATE MEDICINE, 19, Bloomsbury Square, W.C." *Those concerning business matters, non-delivery of the* JOURNAL, *etc., should be addressed to* "THE SECRETARY, The Royal Institute of Public Health, 19, Bloomsbury Square, W.C."

The agents for advertisements appearing in THE JOURNAL OF STATE MEDICINE are Messrs. Van Alexander and Co., 8, Paternoster Row, E.C., Telephone No. 1404, Holborn, to whom all communications with reference to advertisements should be addressed.

Communications which have been sent to other journals cannot be received.

Correspondents who wish notice to be taken of their communications should authenticate them with their names—of course not necessarily for publication.

Telephone number of The Royal Institute of Public Health, No. 1614 Central.

A NEW ENAMEL.

AN elaborate and careful series of experiments has demonstrated the fact that at last we have an enamel for baths, etc., which is acid and alkali proof. This enamel, which is manufactured by the Pure Enamel Bath Company, Limited, is either pure white or pea green, which is, perhaps, inferior in colour but superior in all other practical qualities. Ordinary domestic iron baths may be enamelled by this process within a few hours, and so great is the heat employed that the enamel is fused into the iron, with the result that the enamel cannot be detached or splintered, and becomes, in fact, indestructible.

The Journal of State Medicine.

THE OFFICIAL ORGAN OF
THE ROYAL INSTITUTE OF PUBLIC HEALTH.

VOL. XI.] JUNE, 1903. [No. 6.

THE ADVANTAGES TO BE GAINED BY THE TEACHING OF THE ELEMENTS OF HYGIENE IN SCHOOLS.

BY

S. G. MOORE, M.B.,
Medical Officer of Health for Huddersfield.

It is recognised that much preventable disease is not prevented, and that our mortality rates are substantially higher than they need be. But this recognition does not seem to be widely spread through the population, and if one may judge by their respective attitudes to sanitation, it is among the very highest and the very lowest classes in the social scale that the greatest ignorance, or at least indifference, prevails. On the one hand, statesmen (who may be regarded as representing the highest classes) appear to regard the public health as of comparatively little moment, and on the other hand, the lowest classes appear to neglect and ignore the most elementary hygienic principles.

The attitude of the former may be ascribed to their attention being more or less compulsorily directed to questions—whether of war, finance, party strife, or what not—which from their nature tend to force themselves to the front, and to leave in the background the subject of State medicine, though the latter is in fact of far greater importance than at least some of the former. Another reason for this attitude on the part of the first-named class is that questions of sanitation are rarely obtruded on their personal attention.

The neglect of hygiene on the part of the lowest classes of the community has so frequently engaged, and does at present so

constantly engage, attention that it may be omitted from consideration here. Moreover, it is the lack of attention on the part of the law-makers which, it is hoped, it will be the tendency of the present paper to remove.

To everyone who has given thoughtful consideration to problems affecting the health of communities, or of classes of the community, the fact will have become plain that, after making every due allowance for the preventable diseases that result from drink, dirt, and the evils concomitant to poverty, there is a remainder resulting purely from ignorance of the rudimentary facts of personal hygiene. And to such thinkers the corollary will have appeared that it is principally, if not exclusively, by dealing with the children by educating them generally and specially that hopes may be entertained of eliminating this source of unhappiness, pain, and death.

It is the purpose of this paper to attempt to examine, so far as the occasion permits, how far the subject of hygiene can profitably be taught to children in attendance at the elementary schools of the country, how far such education can be shown to be likely to have effect, and to show that real advantages will accrue, not only to individuals, but also to the State, by the teaching to children of simple facts bearing on health and disease.

It is necessary, in the first place, to consider to what extent the minds of children eleven, twelve, or thirteen years of age are capable of receiving and assimilating teaching of hygiene—a subject involving for its comprehension a knowledge of physiology, chemistry, physics, and other more or less abstruse subjects. It may be conceded at once that it is not possible to instil into the minds of children an *understanding* of the subject; but it is by no means essential that the underlying principles should be taught—in fact it may be questioned whether it is even desirable. Much more time would be required, much more effort on the part of the scholar, and more highly-trained teachers.

On the other hand, it is clear that the elementary truths of personal hygiene are capable of being expressed in such simple terms that they may be learned by quite young children. A

catechism of health might be prepared setting forth the subject dogmatically in much the same way as an ordinary religious catechism, and the children might be required to learn the answers by heart. Doubtless much would afterwards be forgotten, as happens to other subjects, but also some would remain.

Such teaching would have very widespread influence. In some directions, where, to give it effect, exertion, self-restraint, or expenditure might be required, it is to be feared that long-ingrained habits and customs would impose limitations; but there are other directions where such considerations do not arise, and where, simply from want of knowledge, grievous injury to health and much misery are caused. To give an example: A considerable proportion of the infantile mortality has been repeatedly shown to result from improper feeding. The mortality among breast-fed children is startlingly less than among others. In inquiring into deaths of children less than a year old, one frequently learns that the deceased was fed with "a bit of what was going," "the same as we had ourselves," "potatoes and gravy," and so forth. If the simple fact were brought home to the minds of every parent in the country that for infants less than seven months old all other food than milk is not only useless, but also injurious, already much would have been achieved. This, however, is a single example.

It remains to consider in what other directions the teaching of the subject is likely to have effect.

The influence on the general health of a *knowledge* of the evils of overcrowding, absence of ventilation, presence of dirt in the house, soil, environment, and person, and of the benefits resulting from pure air, soil, water, and from cleanliness, could not fail to be appreciable. To those who are not brought into contact with it the present ignorance on these points would hardly be credible.

A knowledge of the rudimentary facts of dietetics would have a most important influence on health, especially in relation to poverty. No fact is so well known in public health as that poverty and disease go hand in hand; so that in times of commercial depression the death-rate rises, and during pros-

perity the tendency is in a converse direction. What, then, can be more important than that the people should have imparted to them knowledge that would enable them to obtain for their money foods containing the maximum of nourishment, and to avoid such as, while perhaps comparatively expensive, are rather of the nature of flavouring or stimulants? The effect of low wages through "primary poverty" on the health of communities would be to some extent at least obviated did each housewife but know such elementary things about foods as the essential difference between, say, a pound of oatmeal and a pound of tea, or between a pound of rice and a pound of coffee.

Again, in relationship with infectious diseases, much useful knowledge could readily be imparted. This subject is somewhat threadbare, but there is, perhaps, time for a single example. How much suffering would be spared, and how many lives saved did but each mother know that with regard to the infections peculiar to childhood, not only is the probability less that children will contract such maladies the longer they escape them, but also that the older the patient is the less severe will be the attack!

Another subject to which attention may shortly be drawn in this connection is tuberculosis. It will occur to everyone that there are many simple facts capable of being learned by children, the knowledge of which would go far to save themselves and their families from this disease.

Among other subjects into which one might go did time permit may be cited infectious diseases other than those notifiable, such as influenza, parasitic diseases, diseases of nutrition and of the respiratory system; but perhaps enough has been put forward to establish the thesis that much good to individuals and substantial advantage to the State would result from the systematic teaching of the rudimentary facts of hygiene to children in the elementary schools of the country.

Taking the census year 1901, the population living in thirty-three large towns (11,464,957) equals 11½ millions, and the deaths 212,500, equal to a rate of 18·6 per 1,000. In the same population the following rates occurred:

	Deaths.	Rates.
Infantile mortality	56,508	4·92
Principal epidemic diseases:		
Small-pox	242	·00
Measles	4,952	·43
Scarlet-fever	1,916	·19
Diphtheria	3,476	·30
Whooping-cough	4,133	·36
Continued fever	1,916	·17
Diarrhœa	14,043	1·23
	30,678	2·68
Diseases of respiratory tract ...	51,556	4·5
Diseases of digestion	17,185	1·5
		8·68

It is not possible to form an estimate of the degree to which these rates would be reduced if such teaching as is advocated were in vogue; but they are put forward to show roughly what proportion of the total death-rate is to some degree at least preventable. The infantile mortality rate may not be added to the others, because included therein are some causes of death which are included in the other rates. Omitting this altogether, although a part might properly be counted, it is seen that a rate of 8·68 of a total of 18·6 results from causes which would undoubtedly be obviated in part as a consequence of increased knowledge of personal hygiene.

For some years past French statesmen have found it necessary to adopt special means to overcome the effect of a low birth-rate. In England this rate is progressively decreasing, and that to a considerable degree. It is recognised that the prosperity of a country is associated with a healthy and increasing population. It is therefore of importance to the State that every reasonable means be taken to secure such a population in this realm. And since the birth-rate is substantially decreasing, the subject becomes of real importance and of some urgency. In the teaching of hygiene in the elementary schools there is a means which promises much in the desired direction, and, moreover, the effects thereof would be largely immediate. They would not be altogether deferred until the present generation of children becomes adult, because the children of to-day would carry the knowledge into the homes of to-day, and thus some benefit would accrue at once.

PRACTICAL HYGIENE IN ELEMENTARY SCHOOLS.

BY

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THE teacher in the elementary school is often blamed by the specialist in some department of knowledge for inefficiency and poor results. His drawing methods do not please the artist, nor his school songs the musician. The military faddist would have all boys incipient soldiers, the expert in technical instruction would have them all youthful Tubal Cains. The subject of Hygiene, however, is one of such vast importance that no one can be blamed for anxiety and effort to insure that due attention is given to its teaching and practice in our elementary schools. One need not labour the point that on a due appreciation of the principles of practical hygiene by the children now at school depends to a large extent the comfort, development, and success in life of the next generation. The teacher is, again, often criticised for the faults of the curriculum of study in use in his school. He is, however, a man under authority, and though less hampered now by regulations than in past years, has yet to work on prescribed lines. In such a subject as the one with which we are dealing I believe no one will be found more ready to aid, in the future as in the past, in what makes so definitely for the public weal, by adapting his teaching, as far as his opportunities permit, to imparting knowledge which shall produce healthy and self-controlled men and women, and intelligent parents. My remarks will not be strictly confined to "health" *teaching*, but any portions of the school economy which seem pertinent to the subject will be considered in passing.

PAST WORK.—You will all be aware that in the elementary schools we work under regulations issued in an annual code. Before 1900 the subjects of instruction were divided into the compulsory, class, and specific subjects.

The specific differed from the class subjects in being taken only by the upper classes in the school, and in being examined and paid for individually.

Among the class subjects, examined, as the term denotes, *en bloc*, was included domestic economy for girls; under the specifics, animal physiology and hygiene.

These were the only subjects under which *direct* instruction in the laws of health could be given.

In 1899, of 5½ million children on the school rolls, about 2 per cent. (all girls) were taking domestic economy, while about 1 per cent. (mainly boys) took animal physiology. These figures may appear slightly misleading, since the 5½ millions include boys, girls, and infants; still, they are sufficient to indicate the very small number of children who were then receiving *definite* instruction in the subject under consideration.

In 1900 what is known as the Block Grant was introduced. Separate payments for separate subjects then ceased, and schools now obtain a grant of 22s. or 21s. per scholar. The figures for 1899 are thus the only statistics obtainable of the number of children receiving instruction in given subjects. Under the new arrangement all schools must take certain subjects, including "Lessons on Common Things," while a list of additional subjects is given in the code, one or more of which is to be taken when the circumstances of the school, in the opinion of the inspector, make it desirable. In this list are found hygiene, animal physiology, domestic economy, elementary physics, and chemistry. Besides this, special grants are paid for cookery, laundry work, dairy work, and household management. The instruction in all subjects is to be in accordance with a syllabus, which must be produced to the inspector at his visit. Under Article 16, any other subject desired may be introduced if the scheme for teaching is approved by the inspector. You will thus see that the present regulations give much more opportunity than did the old for introducing into the elementary school curriculum any desirable subject without increasing to any great extent the teacher's responsibilities, or distracting his attention from compulsory work. We now come to our next point.

Present Opportunities.—Some bodies have suggested that the teaching of the principles of hygiene should be made a definite and separate subject altogether in the school course. I do not

advocate this. Separate subjects must find a place in the school time-table, a document already overcrowded. The teacher's ingenuity is sufficiently taxed in insuring that the numerous subjects with which he has to deal shall all receive their due amount of time and attention. For some years past the Leicester School Board has with great success carried out a scheme of hygiene teaching arranged by its Board inspector in both boys' and girls' departments. Among others, the Bradford Board has an admirably arranged elementary science course, dealing largely with hygienic principles; but, as far as I can gather, few schools make a *special* effort to teach hygienic principles other than incidentally.

What, then, is to be done? We must consider if subjects are already taken under which hygienic teaching may be suitably included. From returns kindly sent me by the clerks of many of our principal School Boards it seems probable that domestic economy is taken in the majority of our girls' schools, and elementary science in most of the boys'. Here, then, is the opportunity. Let the desired teaching be given in set lessons included in the courses for these two subjects. Note, too, in passing, that our boys have been most neglected in this matter in the past. Girls have for years received, at least, some instruction under the head of domestic economy, but the boys have had, with few exceptions, no *definite* and *continuous* courses of lessons. In most schools these subjects are not taken till the upper classes are reached. Some would perhaps deprecate hygienic teaching for junior classes, but surely the teaching of the principles of cleanliness of body and habit, of temperance in eating, drinking, and exercise can be made as simple as necessary, and cannot be begun too early. This may be done by including in the object-lessons on common things—a compulsory subject in every school—suitable lessons, carefully drawn up, and forming a connected series in the year's work. I do not propose to incorporate in this paper lists of suitable lessons, or to presume to advise on the actual procedure of teaching. These are matters which will readily suggest themselves to all teachers of experience, but it may be as well to show that the subjects I have mentioned can

readily be made the vehicle for that instruction which all interested must have at heart. Under domestic economy, lessons are commonly given on the structure of the human body: its chief organs and their functions; food: its composition, use and abuse; clothing; air: ventilation, lighting and warming of dwellings; washing, etc. It is an easy matter in an elementary science course to introduce lessons similar in aim and scope to these. Lessons on water necessarily deal with impurities and means of removal; a lesson on air leads on to ventilation principles and methods; the chemical constituents of food, its storage and preservation, may be dealt with—in fact, there are few points necessary to be taught which cannot be considered under this head. In those schools—and they must be few—which give no instruction in domestic economy, elementary science, hygiene, or animal physiology, the compulsory subject, lessons on common things, can be made to serve the desired purpose. In schools which are fortunate enough to have the use of centres where cookery, laundry-work, or household management is taught, opportunities for "health" teaching are enormously increased.

It may be as well to examine here the aims of the Board of Education in fostering the adoption of these subjects. In the teaching of cookery strict attention is to be paid to cleanliness, order, and economy; the dishes taught are to be suited to the wants of the working classes living in the neighbourhood; the apparatus is to include such appliances as are found in their homes; and the children are to have some knowledge of the dietary value of the foods cooked. Not only are the children taught to do the actual cooking, but to clean and store tidily the utensils used. In their third-year course they deal with the expenditure of wages on food, the use and abuse of tinned foods, and preparation of food suitable for infants. In the laundry-work course cleaning of utensils is again an important section, whilst explanations of hard and soft water, and the different kinds of soap, are given. Household management is as yet not widely taken. It includes the study of cooking, laundry-work, and housewifery, and requires a knowledge of the elements of hygiene

and physiology. The expense of working the course and providing the necessary apparatus probably form an obstacle to its wide adoption. The intention is that it should be a course of instruction to fit girls on leaving school for the various household duties which devolve more or less upon all women.

Among the more recent regulations for the guidance of His Majesty's Inspectors is one stating that they are to report on the suitability of the instruction given to the circumstances of the children and the neighbourhood. This direction is particularly appropriate to health teaching. In the rural districts, questions of water-supply, milk-supply, and sewage disposal arise; in manufacturing districts, diseases peculiar to the operatives; and in mining centres the dangers of the workers underground call for special treatment.

Position of the Board of Education.—The Board of Education has confined itself in its codes mainly to regulations which shall insure the *physical* wellbeing and comfort of the child. Its building rules have been carefully drawn up with this end in view, though unfortunately many schools exist which are far below the standard requirements. It takes cognizance of infectious diseases by forming rules to govern the exclusion of children or the total closure of schools in case of epidemic. The Local Government Board issues a "Memorandum on Epidemic Sickness," and the Medical Officers of Schools Association a "Code of Rules for the Prevention of Infectious Diseases in Schools." These two publications should be in the hands of every teacher. The opinion of teachers, as far as I have been able to gather it, seems to be that parental prejudice, ignorance, and carelessness are still rife in dealing with this matter. It is to be hoped that increased instruction of the kind we are advocating may result in a more serious apprehension of the responsibilities incurred by those who thus disregard the welfare of the community.

The Board of Education attends also to the physical exercise of children. Last year a model course of physical training was issued, including simple movements calculated to insure smartness and activity, and to develop the muscles rather than to serve as display. Breathing exercises, a matter of great importance,

and movements with dumb-bells and staves, are also provided for. Except that allowance must be made where space is limited, and that an expert should be engaged where the staff is small, or where teachers do not feel thoroughly competent to direct the instruction, the Board's scheme should be of great use.

The Prime Minister, in a recent reply in the House of Commons, spoke of physical training as being embraced in the term "secular," pointing out inferentially that any course of education which omitted physical training would be incomplete.

Realizing the inadvisability of teaching the child of imperfect and undeveloped intellect side by side with the normal child, educational authorities have been empowered to provide separate schools in which such children may be taught. The Board of Education pays special grants towards their maintenance. Many of these schools are now at work, and children, having attended them with beneficial results, are often passed on thence to the ordinary elementary school.

These points, then, are in the main all that the Board of Education concerns itself with as regards the child's environment. With regard to actual teaching, the Board requires as a condition of grant payment to any school that all reasonable care is taken to bring the children up in habits of cleanliness and neatness, beyond which, and the suggestions already quoted from the cookery regulations, etc., little else on the subject of hygienic teaching is advocated.

Having thus put before you the past position of our elementary schools, the present opportunities, and the position taken up by the Board of Education in this matter, I do not think I shall be charged on the one hand with a desire to relegate this important question to a secondary position, or on the other with an endeavour to increase the tale of bricks required from the teacher, if I suggest that the logical outcome of my remarks, so far, is that the Board of Education should be requested to include an article in the code to the effect that definite instruction should be given to all children in the senior departments of all elementary schools in the principles of hygiene, such instruction to be introduced into whatever subject of the school course the teacher considers

most suitable. I am convinced that this instruction is largely given at present, but in many cases only spasmodically. As with every subject, for the teaching to be of use it must be continuous and connected.

THE ATTITUDE OF SCHOOL MANAGERS.—School managers and members of School Boards will be found, I believe, largely sympathetic with whatever tends to improve the physical culture and welfare of the children in their schools, but their will being limited by their means, the chief advances have been made so far by the larger School Boards. Most Boards issue for the use of caretakers stringent regulations as to cleansing and disinfecting of schools. The following extracts from those in vogue under the Plymouth Board may be taken as a type:

Daily Duties.—Lavatories and offices to be frequently flushed, disinfectant powder to be placed around sinks; floors to be sprinkled with a disinfectant in the dinner hour, and windows opened to ventilate rooms.

Weekly Duties.—Cloakrooms, entrances, offices, etc., to be scrubbed; yards, sinks, playgrounds to be cleaned of rubbish and dirt. All rooms to be scrubbed monthly.

This work is all carried out under the report and supervision of the principal teachers.

Some Boards issue to their teachers hints on school hygiene, which should prove very helpful. The clerk to the Nottingham School Board has compiled a most useful manual on the subject, which is distributed to all members of the staff. The practice of some Boards of issuing leaflets, dealing with precautions to be taken and simple treatment to be followed in case of outburst of an epidemic, is to be commended. The advice given should, of course, be drawn up by a medical man. The Plymouth, and doubtless other Boards, direct that the health maxims prepared by the National Association for the Prevention of Consumption shall be taught in their schools.

Many Boards provide for optical examination of their children, conducted either by an oculist or by the teachers, aided by some test such as Snellen's, or Curry and Paxton's. The London, Bristol, Swansea, Northampton, Nottingham, Exeter, Leeds,

Sheffield, and Plymouth School Boards, among others, are all undertaking this duty. That there is need is shown by the returns available. At Nottingham, of 8,598 boys and 7,502 girls examined in October, 1901, 21·7 per cent. and 32·6 per cent. respectively were found to have defective sight. Several children were sent to an oculist, it is gratifying to learn, "just in time to avert imminent blindness."

Aural examinations are held by a few Boards, while the London Board provides for the dental examination of children in its schools for the blind and deaf. Managers may be accused of a grand-motherly care for their scholars, or of undertaking too much at the public charge by these efforts, but it is well to note how much undetected defects in vision or hearing nullify the teacher's efforts to impart instruction. A Board's functions, however, would seem to end when the parent has been informed of the results of these examinations, leaving him free to take advantage or not of the advice tendered.

Splendid work is being done by many Boards which provide instruction in swimming, either in their own school swimming-baths, or in baths belonging to the Corporation or other bodies. The London, Nottingham, Leeds, Bristol, and Sheffield Boards all arrange for this. In seaport towns instruction is also largely given in the open sea by teachers voluntarily.

You will thus see that managers are—at least, in the larger centres of population—fully alive to their responsibilities, and have gone much beyond what the Board of Education has required of them.

THE TEACHER: HIS INTEREST AND EXAMPLE.—I use the word "example" here to denote the unconscious effect which the teacher's plans and arrangements to secure that cleanliness and neatness demanded by the code must have upon the children under his charge.

Under the head of "interest" I believe there is little to be desired. From correspondence and conversation at various times with a number of representative teachers, I find that the majority have some kind of inspection of children at every school opening, when hands, faces, boots, and general appearance are examined.

Teachers generally exercise a watchful care over the cleanliness and sanitary conditions of their schools, and inculcate in their pupils by occasional homily, advice or reproof, tidiness of dress, care of the person, and cleanly habits. Teachers can be, and are, of great help to Sanitary Authorities by notifying to them suspicious cases of illness, and a letter of advice or a word in season to the ignorant or thoughtless parent is often effectually sent or given.

Many teachers have on their own initiative ceased to use slates in their schools. It would not inflict a great hardship if their use were entirely forbidden and paper substituted. I need not describe their suitability for the spread of disease, and for the encouragement of spitting, followed by the use of the sleeve or some foul rag or sponge. Their use is particularly to be deprecated in view of the present crusade against tuberculosis, the germs of which are so freely disseminated by expectoration.

The public may feel assured that teachers fully realize the extent of their responsibility for the physical as well as the mental welfare of their pupils. Even if no direct instruction were given in the schools on hygienic matters, the example of the teachers, the processes of cleaning, disinfecting, and ventilating daily going on around the child must make some impression, and cause him to ask, "What mean ye by this service?"

One would hope that a continuance of such efforts as those quoted on the part of our teachers, together with definite teaching on the lines indicated, may do something to remove in the next generation not only the ignorance which prevails, but what is more difficult to deal with, the prejudice. The clerk to the School Board of Exeter remarks in a letter, "There is such a mass of prejudice to break down as to render any instruction which does not carry absolute conviction to the learner of very little good." That this is largely true is seen in many ways. The evidence at coroners' inquests on infant deaths unfortunately shows how hard prejudices die. I have already mentioned that preparation of food suitable for infants is included in the cookery syllabus, and rightly so. To quote from the address of the President of the south-western section of the British Medical Association, recently held in Exeter, "Lack of instinct is nowhere shown to demonstra-

tion more clearly than in the feeding of an infant. . . . The care a child requires is not a matter of common knowledge." The dislike of bathing on the part of some of the pauper class, the objections to carry out the regulations relating to infectious diseases, the unwillingness of workers in dangerous trades to use the precautions provided, are all instances of an unwise conservatism on the part of our working and lower classes. But we cannot do much more with the adult than appeal to reason, and trust that the education of the young may provide the remedy for the future. Lord Salisbury, speaking at a meeting in 1898, convened by the National Association for the Prevention of Consumption, said, "It is the public only who can effect a change, and it is only by public knowledge any real good will be done. You must be content with preaching your salutary doctrine, and not think of applying to the secular arm. It must be taught; it cannot be enforced."

THE TEACHER'S TRAINING.—If the teacher is to deal more closely with this subject in the future due provision must be made in the course of his training to secure that he himself is fully instructed. Teachers are regarded as fully qualified after passing the "certificate" examination, either as "acting" teachers (*i.e.*, those who continue their work in the schools while reading for their examination), or after residence or attendance at a training college. In the syllabus for the 1903 examination for acting teachers the Board of Education has incorporated the following under the head of "School Method":

School Hygiene.—Ventilation—Heating and temperature—Overcrowding—Posture—Play and games—Cleanliness and appearance—Signs of fatigue in children—Influence of health on efficiency of work—Unhealthy children—Common signs of depressed health: pallor, wasting, ophthalmia, stunted growth—Neglected children—Underfeeding—Children requiring special attention—Crippled children—Mental deficiency, real and apparent—Apparent deficiency due to malnutrition, irregular attendance, errors of vision and deafness—Onset of acute diseases requiring immediate removal—rashes, sickness, swellings, feverishness irritability, fits.

This insures to some extent that the necessary knowledge is possessed, but an idea of the elements of animal physiology would make the study of this syllabus much more intelligent. Training college authorities have now very largely the power of drawing up their own schemes of study. Probably the best subject in their curricula under which health teaching could be included would be that of school method, as with the "acting" teacher. It is not too much to ask, I think, that in the first year of residence the elements of animal physiology should be studied. On this, in the second year, could be grafted the full consideration of the points above mentioned. The future vocation of the student should be borne in mind during science lectures, and, when possible, the questions of air, water, food, etc., suitably dealt with.

EVENING CONTINUATION SCHOOLS.—I have dealt so far only with the training of children in the day schools, but we shall crown our work there and greatly multiply its good effects if we can induce the students in our evening schools to continue their studies in hygiene and kindred subjects. Much has already been done. I find that the majority of evening continuation schools include ambulance teaching in their courses. Under the London Board, for example, 200 out of 400 departments teach this subject. Hygiene as a science and physiology are also taught, and in many schools health lessons are included under "Life and Duties of a Citizen." How evening schools will be patronized under the new scheme now coming into force we cannot predict—better than in the past, let us hope. In the new syllabus, under "Knowledge of Common Things," the Board of Education requires instruction in:

Leading features of physiology—The home, including design and construction on hygienic and economic principles—Materials—Fixtures and furniture—Heating and lighting—Clothing—Food and beverages—Cleanliness and disinfection—Safety from accidents and injuries—First aid to the injured and simple remedies—Means of relief and comfort for the infirm—Precautions against endemic and epidemic diseases.

This course, if widely taken up and well taught by those who

know how to teach—and I emphasize this point—should be of great service.

The New Authorities.—I have had to deal in this paper with new conditions of instruction. If we should have to carry out that instruction under new systems of management in the future, I trust that the proposed local authorities for education will seize the opportunities afforded them. Their first duties should be to put *all* schools in a thoroughly sanitary condition, to see that they are well ventilated and warmed, and gradually made as perfect as money can make them. If swimming-baths or centres for special subjects are required, no question of expense should prove an obstacle. If they do as well as the majority of the large School Boards have done we shall not complain.

METROPOLITAN ASYLUMS BOARD.

With a view of enabling some candidates for the diploma in public health to comply with the regulations of the General Medical Council relative to instruction in fever-hospital administration, the Hospital Committee have sanctioned the admission of such candidates into the Board's acute fever hospitals in the capacity of clinical assistants, subject to the conditions contained in the following resolution adopted by the managers on November 6, 1886, after consultation with the Local Government Board, viz.:

"That the suggestions of the Local Government Board—viz., that the gentlemen to be engaged as clinical assistants shall be registered medical men . . . shall have specified duties . . . and shall be in all respects subject to the regulations in force with regard to the hospitals—be adopted by the various hospital committees; that the remuneration of such assistants be limited to the allowance of residence and rations, or partial rations, as suggested by the Local Government Board, and that that Board be informed accordingly," and subject to the following further conditions:

(*a*) That the period of appointment of a clinical assistant shall be three months; and (*b*) that the "specified duties" referred to in the Board's resolution above set forth shall be those generally allotted by the medical superintendent to the junior assistant medical officer of his hospital, and such other duties as he may determine.

THE TEACHING OF HYGIENE IN ELEMENTARY SCHOOLS.

BY

THOMAS BURNELL,

Member of the Criccieth Urban District Council.

"HYGIENE," says one authority, "belongs properly to the training of the home," and the subject of this paper seems, therefore, to suggest that this training is ineffective, or that it needs supplementing, and hence the proposal that the laws of health be taught in the schools.

Members of Urban and Rural Councils know only too well how slow and laborious a task it is to introduce any kind of sanitary reform. They are responsible for protecting communities against unsound food, impure air, and infectious diseases, and yet the very communities that place this responsibility upon them frequently retard sanitation by their apathy and neglect, and at times even directly oppose sanitary progress altogether. There is, moreover, a general aversion to the public official, whose visits are looked upon by the house occupier as an interference with his individual liberty, or connected with that necessary evil, the paying of rates. This aversion is especially strong among the poorer classes of a community, and is undoubtedly one objection to compulsory vaccination. But while it would be folly to argue against the freedom of the individual, it must be admitted that, as one writer has well said, "In conserving this wide freedom to some citizens, we must remember that the result of their unwisdom falls with terrific force on certain other citizens—the children. The children are among our citizens; they are the whole of our citizens of the future." To effectually educate a community, therefore, in the principles of hygiene, the proper training of the children must be an important factor. Now, inasmuch as the child's life is divided into home and school life, it is essential that any defects resulting from improper home training through the ignorance or carelessness of the parents should, as far as possible, be more than made good by the person

who, for five days out of seven during, say, forty weeks of every year, stands *in loco parentis*, viz., the school-teacher. It is obvious, therefore, that upon the schoolmaster and schoolmistress we must chiefly depend for any great improvement in the physique and general health of future generations.

Whether this training should be limited to the primary schools is a question which might profitably be discussed in connection with this paper, and will be referred to again at a later stage.

The proper place for the teaching of hygiene in the primary schools is during the lessons described in the Education Code (Art. 15, b. I. and II) as "Elementary Science," or in the lessons on "Common Things." All the schools include one of these branches of instruction in their curriculum, and, in addition to this, the children in the higher standards as a rule write brief compositions, in which they reproduce in a written form in their own words the ideas which they have acquired through oral instruction.

What is required is a series of lessons which, while aiming at teaching children to observe carefully and to make inferences for themselves, will at the same time inculcate in them the importance of strict personal cleanliness, and a desire for healthy surroundings, and thus enable them to do what in them lies to prevent any violation of the laws of public health. Very few technical terms should be introduced in the lessons—in fact, all that is purely technical should be carefully avoided—and the aim should be to train the reasoning powers rather than to store the memory with scientific names. There should be no attempt at the systematic study of science as such, for it must be remembered that "The mental development of children in primary schools has not reached the stage when specific study of a particular science is profitable" (*vide* Education Code).

But the lessons in hygiene, although not continuous in the sense of forming a systematic study of a particular science, should be classified into convenient groups. As in the case of "object lessons," the selection of subjects for study should be carefully thought out and designed to produce a definite result. It is very little to the purpose, for example, to teach that air is a

mixture of gases, that air has weight, and that wind is air in motion, or even to teach by experiment the absorbent properties of liquids—that if, for example, two saucers, one containing clear water and the other a liquid possessing a strong odour, be placed side by side in a closed cupboard the water in time partakes of the odour of the other liquid—unless the principle is applied to explain the tainting of the surrounding air and of our water-supplies by the close proximity of decaying animal or vegetable matter.

Ventilation is important. It is a large subject, and effective teaching of the principles of ventilation requires careful preparation for the lesson, but the subject cannot be intelligently or practically taught without some real knowledge of respiration. A group of lessons including this subject should therefore properly have also at least one lesson on "The Air in Relation to Health," or "Changes Produced in the Air by Respiration."

In a primary school a year's course of lessons in "Elementary Science" or of lessons on "Common Things" is practically limited to thirty in number. A list of thirty could, however, very well include such groups as the following, most of which are modifications of schemes suggested in the Education Code, and all of which have from time to time been given in a school for boys (100 on books) and a girls' school of the same size in a small seaside place having a population of 1,500:

1. Solvents and solutions. Porous things. Filtration. Filters. The earth a filter. The boiling of water as a means of purification. Distillation of water. Springs. Water-supplies of towns. Water. The water we drink. How obtained. The special properties of water as ascertained by observation and experiment.

2. Vapour. Spring-water. Rain-water. Sea-water. Stagnant water. Drainage. Drainage as a means of lowering the water level. Site for a house. Sewers. Ventilation of sewers.

3. Air. Composition of air. The absorbent properties of air. Water. Absorbent properties of water. Simple experiment illustrating the fact that water will absorb gases. Application in the construction of traps. Wells. Good and bad positions for wells. Prevention of ill-health and of the spread of infectious diseases. Essentials of a health resort.

4. Pure air and sunlight as essentials to health. The sunny aspect for a house. Changes produced in the air by respiration. Ventilation. Experiments with heated air. Pure and vitiated air. Rules for ventilation. Fermentation. Decomposition. Bacteria. Disinfectants.

LESSONS FROM CHEMISTRY.

5. Elements and compounds. Chemical combination. Combustion. Gases. Acids. Alkalies. Salts.

LESSONS FROM PHYSIOLOGY.

6. The circulation of the blood. Oxidation. Respiration. Waste and repair. The skin. The teeth. Foods. Digestion.

The above groups are not suggested as complete or perfect models. Groups 5 and 6 are intended for the higher standards only in a school. The first four groups have a common aim, but they give scope for variety. Local circumstances also have to be considered in arranging the series of lessons, for the real value of the teaching will be lost if the children have no opportunity of studying the subjects under ordinary conditions. The lessons on water-supply, for example, were supplemented by instruction on the spot, a visit being made for the purpose to one of the local reservoirs. Moreover, also, the aim should include the fostering of a desire on the part of the children, when they leave school, to take an intelligent interest in their surroundings, and it is surprising what a keen interest children take in such lessons when the teaching in the schoolroom can be applied to objects of observation outside.

Reference has been made to secondary schools, and for the following reasons :

The Education Act of 1902 makes provisions for systematic secondary education for England. Wales has had the advantage of such a provision since the passing of the Intermediate Education Act. The county schemes framed under that Act include the teaching of natural science to boys, and, in some schools, to girls also, and where there is no such provision in the curriculum for girls, domestic economy and the laws of health are substituted. The schemes require also that "classes in scientific and technical subjects shall in all cases be associated with sufficient experimental demonstration and practical teaching." The advantage to the pupils of practical work is obvious, for it is not merely by seeing experiments tried, but by trying them for themselves, that the pupils best learn the properties and structure of the objects they study.

Knowing that the hygiene of the home suffers if the parents are ill-instructed or careless, it is important to see that in the school the teaching of the laws of health is entrusted to the care of well-instructed schoolmasters and schoolmistresses.

When it is remembered that the majority of the teachers of our primary schools have not themselves had the best teaching in the subject of public hygiene the question arises, How is the difficulty to be overcome?

Much has been done in recent years by the County Councils in making provision, in suitable centres, for classes in special subjects for teachers on Saturdays. In Wales the University Colleges, assisted by the County Councils, have also done good work in this direction. With the creation of Education Authorities over large areas (county and borough), the arrangement of the curricula of primary and secondary schools will not only be systematic, but the great assistance in the promotion of practical instruction, which hitherto in some cases the combination of adjacent districts has afforded, will be now more generally available. Peripatetic teachers will no doubt supply to some extent the need in those rural schools for additional teaching power where there are not at present adequate and well-qualified staffs of teachers for the purpose.

The plan of holding joint conferences of representatives of county education committees, school managers and teachers, which has already been found advantageous in many parts of the country, should be more generally adopted now.

In the compass of a paper of this kind there cannot be anything like an exhaustive treatment of the question of the teaching of hygiene. While its aim has been mainly to treat the subject from the point of view of the practical teacher, it is hoped at the same time that something has been said that will help to arouse public interest in a subject which is of far-reaching importance to the well-being of the nation. Moreover, it is hoped that the discussion of the subject will do much to further the progress of individual and public hygiene, and remove the existing apparent apathy of the public in the matter of sanitary reform.

A FEW FACTS CONCERNING REFUSE DESTRUCTORS.

BY

W. FRANCIS GOODRICH,
Of London.

(*Continued from page* 256.)

The late Mr. John McTaggart, of Bradford, will always be remembered in connection with the utilization of clinker. Eight years since it cost the Corporation of Bradford £1,000 per annum to cart the clinker to tips; since that time a number of mortar-mills, clinker-crushers, and screening plant, also a hydraulic slab machine, have been adopted. The result is seen in the following figures, a dead loss having been converted into a net profit of several hundred pounds yearly.

According to the last annual report issued by the late Mr. John McTaggart, clinker and clinker products were selling freely and in increasing quantities, as may be seen from the following comparative figures:

Year ending March 31, 1900.

Mortar sold	7,179 tons.
Crushed screened clinker sold ...	11,692 loads.

Year ending March 31, 1901.

Mortar sold	11,907 tons.
Crushed screened clinker sold ...	12,701 loads.

Mr. D. McColl, the Cleansing Superintendent of Glasgow, in a recent lecture, gave some interesting details concerning the disposal of destructor clinker in that city. The whole of the clinker is mechanically crushed and screened to five different sizes, being readily sold for concrete and other work. In the year 1896-97 2,183 tons were disposed of, realizing the sum of £242. During the past year the quantity disposed of increased to 9,538 tons, realizing the sum of £1,095.

Brickmaking promises to afford another useful outlet for clinker. The late Mr. McTaggart conducted a series of experi-

ments about two years ago, the outcome of which is likely to be very remarkable and far-reaching. The bricks are made from a 10 per cent. mixture of hydraulic lime and clinker, and it is said that they can be produced for 14s. per 1,000. Specimen bricks were carefully tested in the Engineering Department Testing Laboratory of Bradford Technical College, with exceedingly satisfactory results.

That the making of bricks from clinker is not a visionary project is shown by the fact that quite a number of municipalities are now seriously considering the advisability of installing brick-making plant.

Within the next few months a plant of this kind, made by Messrs. Alexander, of Leeds, will be working in connection with a large Meldrum destructor, now being erected for the Metropolitan Borough of Woolwich, combined with the new Electricity Works at Plumstead.

The recent decision of the Brighton Corporation to install a brickmaking plant for utilizing their clinker has exercised a disturbing influence upon that well-known organ of the brickmaking industry, the *British Clay-worker.* In a recent issue a leaderette is devoted to this matter, and it really is painful reading, although freely interspersed with sarcasm such as the following: "Buy your bricks of the Brighton Corporation. All bricks of best quality. Made of pure refuse only. Every brick guaranteed and stamped with the common seal of the Mayor and Corporation of Brighton, without which none are genuine. Refuse imitations."

Now, however impossible the utilization of clinker for the purpose may seem, even the most sceptical may reasonably be forgiven for seriously considering that the clinker brick is likely to be a severe competitor against its orthodox clay prototype when a responsible trade paper comments in this strain.

Whatever may be done in the future in this direction it is impossible to forecast, but it is quite certain that methods of usefully employing clinker will be found. Clinker utilization has only come prominently before us during the past few years, for the all-sufficient reason that vitreous and innocuous clinker is

quite a modern product, practically unknown before the advent of the modern high-temperature destructor. Many years ago, when the Jones cremator was added to many destructors in this country, although nuisance in the way of noxious fumes from the chimney was effectually prevented, yet this secondary fire could have no possible beneficial effect upon the clinker, which was still removed from the cells in a soft and objectionable condition, giving off a most disagreeable smell, and having no commercial value. It was indeed incongruous that, while the chimney was practically free from nuisance, the clinkering floor should be so objectionable. Mr. Charles Jones did good work, so far as it went, and is to be commended, but this was the inherent weakness of his cremator.

The utilization of clinker for the manufacture of paving flags continues to find favour, and a number of municipalities have now adopted flag machinery at their destructor works.

Among the towns where such machines are in use the following may be mentioned: Bristol, Birmingham, Bradford, Hornsey, Liverpool, Oldham, Walthamstow, and Withington; while quite a number of such machines are in hand for other municipalities, and many more are contemplated, even one for the aristocratic and Royal Borough of Kensington.

Exhaustive tests have been made with flags at various works, and there can be no doubt that, as local circumstances warrant, we shall see great developments in the utilization of clinker for this purpose.

The latest suggested alternative to a destructor is a process having for its object the "conversion" of refuse into a fuel for domestic and manufacturing purposes.

I will briefly describe the process. The refuse is carted to the "converter" and shot on the sorting floor. It is then sorted by hand, all that portion of the refuse which is useless for purposes of conversion into fuel being thrown aside to await removal. The remainder is then passed through a mill, being ground up, and at the same time it is disinfected by the addition of a charcoal mixture.

The material next passes into a mixer, where it is mixed with

various hydrocarbons, and thence into moulds, where it is pressed into briquette form.. It is claimed that at least two-thirds of the average refuse can be converted into fuel, and, further, that as a fuel it is far superior to that obtainable in London at £1 per ton.

It is said that the sorting can be done for 6d. per ton, and that the labour cost for manufacture into briquettes is 7d. per ton; in addition, the fuel ingredients add a further 2s. 6d. per ton to the cost.

Lastly, it is claimed that the process is "as near sanitary perfection as possible," showing a large annual profit instead of a heavy loss, and avoiding the serious initial outlay necessary for a destructor. Now, we will briefly examine these claims: Firstly, it is scarcely necessary to point out that the sorting process at once disposes of the sanitary claim. Nothing could be more retrograde than this: it has been a terrible disgrace to London for years past, and strongly condemned by all sanitarians; it will be observed that the material is not disinfected *before it is sorted*, but while passing through the disintegrater. Sorting is now almost unknown in London, I am pleased to say, and I do not think it is likely to be tolerated again to any serious extent; the weight of opinion is seriously against it. We are told that two-thirds of average refuse can be converted into fuel; this I very gravely doubt. For instance, at this time of the year in London, and also in some parts of the provinces, three-fourths of the refuse consists of garbage: this obviously could not be "converted"; the balance contains very little combustible indeed. If analyses of London refuse are examined it will be found that any time during the year the great bulk would be useless for "converting" into fuel.

It comes to this, then, that if fuel is to be made the foreign or added ingredients must furnish the bulk of the heating power, and that being so, 2s. 6d. per ton does not allow any great margin for such addition.

What price the fuel will fetch depends entirely upon its calorific value; if this is to be high, then the fuel will be costly to produce, and it must not be forgotten that even good patent fuels have a poor sale and are not at all in request.

What is done with that portion of the refuse which is useless for converting into fuel? It has to be carted away and tipped in the good old fashion, and let it not be forgotten that this portion of the refuse contains all the dangerous and most offensive *substances which are not claimed to be convertible into fuel.*

Now, every modern destructor destroys from two-thirds to three-fourths of the refuse, *the offensive material included.* This proportion is a fuel, inasmuch as it yields up all its heat units, and it is a fuel without the cost of manufacture, without the cost of any added combustible matter, and without the cost or filthy system of sorting, sufficient in itself to condemn any process.

In comparing the actual working cost of the two methods, *i.e.*, "conversion" and "destruction," figures are quoted, to which exception must be taken. For instance, we are told that it costs 2s. 6d. per ton to destroy refuse, whereas 1s. is a fair average for the whole of this country; no allowance is made for clinker products, often a good source of revenue; and, lastly, although it is claimed that two-thirds of refuse can be converted into fuel, yet no allowance or credit is given for steam produced from a given quantity of refuse when destroyed. If it is the fact that two-thirds of average refuse has a fuel value, then that heating power could not possibly be extracted more effectually than by means of the high-temperature destructor, but the destructor gets no credit whatever in the comparative figures.

Brickmakers have gladly taken immense quantities of refuse for years past, utilizing but a small proportion as fuel; but they have never pretended to deal with the great bulk of the material at all, and, unfortunately, for all such systems that portion which is of a really dangerous and offensive character is not utilized, but allowed to accumulate in immense quantities.

No system can be considered final or satisfactory which does not deal with the *whole* of the refuse, the residue being vitreous and harmless.

Some continue to wait, fondly hoping that, even as great progress has been made in the past, greater improvements will be made in the future. I have a little sympathy with these people,

because to a large extent their fond hope is but an excuse to cover their own procrastination. We have not reached finality: it would be fatal to cherish any such idea; but, at the same time, it is equally certain that the margin for improvement is but narrow, and not in principle, but merely in detail, which will to some extent appeal to individual fancy or sentiment. The essential principles are sound and correct beyond all doubt, and as such they will endure.

We may see many experiments having for their object the avoidance of handling refuse and the reduction of labour cost. We have seen quite a number already, some very complicated, others very simple: they all appeal to the lay mind. But that will not do: they must effect the results aimed at or they are worthless. Up to the present we have not seen any system of mechanical charging which can show a saving over the original methods, at the same time giving a perfect freedom from nuisance, a high efficiency, and a good vitreous commercial clinker. This is the problem to be solved, and, with some knowledge of what has been done both at home and abroad, I must say that there is no indication at present that it will be satisfactorily solved.

THE SANITARY INSPECTORS EXAMINATION BOARD.

This Board at their meeting on May 20 decided:

1. That a person who has held, for a term of three years, whole-time employment as sanitary inspector, or inspector of nuisances, or sanitary inspector and surveyor, shall, on producing evidence of having passed the preliminary or equivalent examination, be eligible for the Technical Examination, provided that, in the case of a person holding the certificate of the Sanitary Institute or other approved examining body, the term of employment be reduced to twelve months subsequent to having obtained such certificate.

2. That a person who is already on Part I. of the Board's Register as having, prior to December 31, 1898, obtained the certificate of the Sanitary Institute or The Royal Institute of Public Health, be admitted to the Board's Preliminary and Technical Examination without further evidence of instruction or training.

3. To refer to the General Purposes Committee, for consideration and report, the desirability of holding an examination in some suitable centre in the provinces.

THE COMPULSORY NOTIFICATION OF PHTHISIS.

BY

JAMES T. NEECH, M.D., D.P.H.,

Medical Officer of Health for Halifax.

Since the discovery of the tubercle bacillus in the early eighties, and its relationship to tuberculosis in its various forms, as cause and effect, became an established fact, I think the medical profession, at any rate, has been practically unanimous in regarding these affections, and phthisis especially, as a communicable disease. While this is undoubtedly true, I scarcely think the profession, and sanitarians generally, have even yet come to fully recognise the importance of that fact, or to adequately realize the great possibilities of preventing the diseases which underlie it, even by the adoption and strict observance of what may seem to be very simple precautions. I think, however, that the important Congress held last year in London will have served to bring home some of these truths, and cause to be ascribed to them their due weight, because there was laid before that Congress statistical and other information of the most valuable kind which had hitherto not been available; and if the communicability of phthisis, together with the practical methods of dealing with its cause, and the success which is certain to follow the operation of those methods, have been forcibly brought home to the powers that be, and sufficiently impressed upon them to cause them to take action in the near future upon the lines that were advocated and laid down, then the death-rate from phthisis will become a much more rapidly diminishing quantity in the country, and the efforts put forth, the time occupied, and the money expended in organizing that important Congress will not have been wasted or spent in vain. The Congress, among, of course, many others, emphasized three facts, which were previously fairly well known, viz.: That phthisis is a communicable disease; that the chief means by which it is spread from man to man is the sputum of patients suffering therefrom; and that, under suitable conditions, the disease can frequently be cured.

The Congress laid it down "That the provision of sanatoria is an indispensable part of the measures necessary for the diminution of tuberculosis." I take it tuberculosis of the lungs is meant in this paragraph. A great deal has already been done in providing sanatoria in various parts of the country, and a number of public bodies are also taking the matter up. Beneficial results will be sure to follow this movement, because not only will a good percentage be cured, but all under treatment will be separated from the healthy, and consequently many centres of infection removed.

The primary and chief object of these institutions is, however, after all, to cure the disease, and I, for one, will not detract one iota from the importance and great value of such institutions and the work they are destined to carry out; but there is something better than cure, and that is prevention. While we are giving so much attention to the provision of means of cure, we ought, in my opinion, to give more heed to the methods of prevention in the case of the disease. To erect sanatoria for the cure of the disease after it has been contracted seems to me rather like beginning at the wrong end, at any rate as far as prevention is concerned. Again, it will be, I should think, impossible to provide and maintain sanatoria having accommodation sufficient to deal with more than a small proportion of those suffering from the disease; hence there will be hundreds and thousands throughout the country moving amongst the community expectorating broadcast the germs of the disease, and providing fresh patients for treatment in the various sanatoria.

If this disease is to be combated with success, and the death-rate therefrom markedly diminished within a reasonable time, not only must curative means be provided, but, above all, preventive action must be carried out in a most vigorous and thorough manner. The various health authorities, however, are unable to do much in this direction unless the names of the patients suffering from the disease and their residences are known. This can only be secured by including phthisis accompanied with expectoration among the list of notifiable diseases.

There need be no difficulty about this, because the tubercle bacillus among microbes is one of the easiest to recognise, and as soon as that microbe is definitely found in the expectoration, the case, in my opinion, should be notified.

We notify some of the chief zymotic diseases, so that compulsory notification is an established principle. Phthisis causes more deaths every year than all these notifiable infectious diseases put together, yet it is one which could be more easily and more readily controlled than any of them, because if a consumptive takes care to collect and destroy his sputum, he is not a public danger. If, then, these be facts, why on earth is it not made compulsory to notify phthisis with expectoration?

Voluntary notification of cases of this disease attended with expectoration has been in operation for a few years in several large towns of this country, and the increased preventive action which it has rendered possible has been followed by considerable success, but voluntary notification, in my opinion, though useful, would only touch the fringe of the difficulty. There would be no uniformity of action among medical men with regard to notification, and only a small proportion of cases would be notified. It would be necessary for a practitioner to obtain the written consent of his patient before notifying, or he might be liable to an action at law. Again, voluntary notification would not place phthisis under the provisions of the Infectious Diseases (Prevention) Act, and the authority would have no power to enter a house and disinfect after death or removal, and could only do so with the consent of the tenant or landlord, as the case might be, and the thorough disinfection of infected houses is an absolute necessity in the prevention of the disease.

For the above reasons, among others, I am of opinion that notification, to be of far-reaching value and a universal success, must be compulsory. It has been urged against compulsory notification that it is frequently desirable that the patient should not know the nature of his disease. With that view I cannot agree; this might have been very desirable when consumption was looked upon and regarded as meaning certain death, but there is another aspect from which this question can now be viewed. There

is no doubt that many cases recover, and by virtue of that recovery are then thought not to have been phthisis at all, neither the doctor nor his treatment receiving the credit of curing so fatal a disease. But now, by examining the expectoration, a definite opinion can be formed, so that there is no danger of the attending physician making an error in his diagnosis. Consequently, with that certainty, and the great possibility of a complete cure being effected—at any rate in the earlier stages—under proper and improved treatment, I see no reason whatever for withholding from a patient the true nature of his disease. Moreover, to do this, and impress upon him at the same time the great hope there is of recovery under existing methods of treatment, would be a powerful means of causing him to consent to the adoption of those changes in life, and carefully carry out the precautions necessary to the achievement of that desired end. Thus, I hold, to know the nature of his disease would be a benefit to the patient rather than otherwise, as well as affording a protection to the public generally.

Another objection that has been urged against compulsion is that a consumptive often has many years of useful life, and that it would injure his prospects of securing work, etc., if his complaint were made public. To put this objection in other words, it means that because there may be some difficulty in these poor unfortunate individuals securing work and maintaining themselves, they are to be allowed to go about spreading abroad the germs of their disease, to the constant danger of the susceptible members of the community at large. But notification to the Sanitary Authority does not involve notification to the public. Again, in the enlightenment of to-day, is not a person of delicate appearance, suffering from a bad cough with expectoration, whether he uses a pocket-spittoon or not, soon marked by the public as suffering from consumption ?

Dr. Baker, Secretary to the State Board of Health of Michigan, where compulsory notification of this disease has been in operation for several years, says: "They do not find notification of consumption to cause any inconvenience to the patients." The fact that, provided a consumptive takes great care to collect and

destroy his sputum, he is not a danger to the public, has already been referred to; therefore what is wanted is to educate the public and make them understand this, and show them that they run much greater danger under existing conditions than if proper precautions were taken, by which means the danger would be reduced to a minimum. If this were done, the objection about getting work would, I think, fall to the ground.

The above are a few among the many objections that have been raised against compulsory notification, but with which I am unable to deal in a paper like this.

Compulsory notification has been adopted in Norway, but so recently that results of its administration are not yet forthcoming. In a great many cities and states in America it is in operation, and in New York it has been so for several years. In the latter city it has brought out and emphasized three important facts, viz.:

1. That the disease occurs chiefly in infected areas.
2. That fresh cases crop up year after year in individual houses infected with the disease.
3. That compulsory notification, followed by the sanitary precautions which such notification renders possible, leads to a marked diminution in the death-rate from the disease. In New York the death-rate has fallen 30 per cent.

Surely, what can be done in the cities of America can be done in this country, which has always been to the front in hygienic progress, and a pioneer in sanitary reform.

Phthisis being mostly a chronic disease, any system of notification, or any powers exercised in consequence thereof or thereunder, would require to be administered in a different manner than is the case with ordinary zymotic diseases. But we have much more definite knowledge regarding the cause and modes of propagation of the former than the latter; consequently we can proceed on safer ground and more certain lines, and with much greater confidence of success. I see no insurmountable difficulties in the way of compulsory notification, and if voluntary notification can be administered and

carried out with some success, compulsory notification must lead to much greater success. It only requires tact and the authority to work with the medical profession. In all cases of phthisis notified, I should advocate no interference with a patient, so long as such patient was under the care of a qualified medical man, unless such practitioner desired it. I should leave the medical attendant to give all the necessary instructions to his patient, and rely upon him seeing, as far as practicable, that they were carried out. It would only be in cases where the medical man desired it, or where he had ceased to attend, or in cases where no medical man is in attendance, that I think the Health Authority should step in, with a view to insure that the necessary precautions are taken to prevent the spread of the disease. A great deal of effort is being put forth to secure the erection of sanatoria for the treatment of this disease, and the object is most praiseworthy and deserving of success. If ever compulsory notification comes into force, such institutions will be much needed for the treatment of cases whose condition and surroundings demand their removal; but whilst this is true, in my opinion it would be a mistake for Health Authorities generally to embark on expensive schemes for the erection of public sanatoria on anything like a wholesale scale throughout the country. For this purpose fairly large areas should combine. For individual Sanitary Authorities, except a very few of the largest, to attempt this would not be an economical way of isolating the disease, because if it be true that a consumptive who carefully collects and destroys his sputum is not a danger to the public, the number which require isolation will be proportionately small, and supervision at home in cases where it is needed would be a very slight burden indeed in comparison with the maintenance of expensive sanatoria. Then, again, if this disease be attacked in a thorough manner by the authorities, the disease would diminish, and, after a few years, every year would reduce the necessity for such institutions.

This country, evidently, is not yet prepared for compulsory notification, and, if that be the case, is it not incumbent upon

sanitarians, and all interested in the subject, to educate the people, and prepare the way for it? Compulsory notification, it must, I think, be admitted, is the first and only possible step towards the universal application of preventive action, which alone can bring about any marked and rapid diminution in the incidence of disease.

If the Sanitary Authorities of this country would only adopt an efficient and progressive policy, and carry it out in a wise and unremitting manner, this disease, which is one of the greatest scourges to humanity, would, I feel sure, eventually become eradicated, and upwards of 40,000 lives annually saved to the community.

THE POWERS OF SANITARY INSPECTORS.

On May 15 the magistrate of the West London Police Court delivered a judgment which imposes a serious limitation on the powers of entry of a sanitary inspector. A sanitary inspector employed by the Fulham Borough Council desired to inspect a confectionery shop, No. 833, Fulham Road, where the manufacture of ice-cream is carried on.

The prosecution did not allege a nuisance or any infringement of the law, but contended that, under the Public Health (London) Act, 1891, the sanitary authority was empowered to enter premises at will. Section 1 states that "it shall be the duty of every sanitary authority to cause to be made from time to time inspection of their district with a view to ascertain what nuisances exist calling for abatement." Section 10 lays down that "the sanitary authority shall have a right to enter from time to time any premises for the purpose of examining as to the existence thereon of any nuisance," etc.

The decision of the learned magistrate seems to have been due to the influence of the case Vines *v.* The North London Collegiate Schools for Girls, in which the High Court of Queen's Bench in 1899 confirmed the refusal of the magistrate to issue an order on the ground that the inspector was not prepared to furnish a reason for seeking admission, and did not suspect any nuisance.

BACTERIOLOGICAL NOTES.

I.

THE LIMITS OF MICROSCOPICAL VISIBILITY—MICRO-ORGANISMS THAT ARE INVISIBLE.

BY

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It will probably prove a surprise to many to learn that there is a limit to the visibility of objects with the microscope, a limit which does not depend upon the magnifying power. At one time microscopical objectives were made solely with a view to increasing the magnification, and lenses of $\frac{1}{50}$ inch and $\frac{1}{80}$ inch were constructed by Messrs. Powell and Lealand—marvels of mechanical skill. But within the last twenty, or at most thirty, years it has been recognised that it is no use increasing the magnifying power of microscopical objectives beyond a certain point; by so doing, although the object viewed may appear *larger*, no more *details of structure* will be seen than with a lower power lens. This is due to certain properties of light, which have been explained by the "diffraction theory," which is largely due to Professor Abbe of Jena.*

Nowadays a microscopical objective of more than $\frac{1}{25}$ inch focal length is never employed—it is rare, in fact, to come across a lens of more than $\frac{1}{12}$ inch focal length; by using a $\frac{1}{12}$ inch objective of the best construction, such as an apochromatic, which is so adjusted that the image obtained is the most perfect, all the magnification required can be obtained by using a high power eyepiece, which could not be used with an inferior lens, because it would magnify any imperfections and a blurred image would result. The important point about an objective is its "resolving power," as it is termed—that is, its capacity for rendering visible *fine structure*. Microscopical objectives are "dry"—that is, there

* See Carpenter on the Microscope.

is air between the lens and the object viewed—or "water-immersion," or "oil-immersion," in which there is a layer of water or of cedar oil respectively between the lens and the object viewed.

It is possible by mechanical means to rule on glass fine lines, up to something like 500,000 lines, in a space of 1 inch.

Now, it has been proved theoretically, and can be shown practically, that with a dry objective it is impossible to see more than about 97,000 lines to the inch; if more are present, they cannot be seen. With a water-immersion objective some 120,000 lines to the inch can be seen, and with an oil-immersion one some 146,000 lines to the inch. The resolving power—*i.e.*, the capacity for seeing fine structures—is therefore much increased in the immersion system of lenses, and with the oil-immersion there is a gain in resolving power of about one-half over a dry lens. This is why the oil-immersion system of lenses for high powers is now almost exclusively employed. It is, of course, necessary to have a certain magnifying power in order to see fine structures, but it is no use increasing the magnifying power beyond a certain point, because no more *details of structure* will be visible, so that a magnifying power greater than that obtainable with a $\frac{1}{12}$ inch objective with a high eyepiece is now rarely made use of; this suffices for almost all purposes.

By certain means it is possible to increase the resolving power of an oil-immersion objective up to a certain point, as, for example, by using as a mounting medium a substance having a higher refractive index—such as realgar—than Canada balsam, which is commonly employed, and by substituting light of a shorter wave-length than ordinary light for illumination, such as the violet light of the violet end of the spectrum (monochromatic light). Even with these means the maximum resolving power at present obtainable is about 167,000 to 170,000 lines to the inch. If an object, such as a micro-organism, has a less diameter than this it cannot be seen; the limit of microscopical visibility has been reached. Now, this is not so very much below the size of many micro-organisms. Some well-known micrococci are not more than $\frac{1}{50000}$ inch in diameter; quarter this, and they could

not be seen by the very best optical appliances at present available!

In many infective diseases no specific micro-organism has up to the present been detected with certainty or isolated; and though in some cases this may be due to the fact that the microbe is scantily present, is localized, or will not grow on our artificial soils, in others it may well be that it is so minute that it cannot be seen. That this is not merely a hypothesis is proved by the fact that in certain diseases there is unquestionably a microbe present that is so small that it is invisible with the best optical appliances of the day. The following are some instances of this, together with the proof on which this assertion is based:

In pleuro-pneumonia of cattle Nocard and Roux have found in the serous fluid of the pleural cavity fine granules, just visible with a magnification of 2,000 diameters and after staining with thionine blue. By filtration through a Pasteur-Chamberland F or Berkefeld filter the fluid loses its infective properties. These observers consider these granules to be the specific microbes. It is true they are not quite invisible, but they are certainly on the borderland.

The fluid present in the vesicles in foot-and-mouth disease contains nothing microscopically, both without and with staining methods, that can be said to be a microbe. Yet this fluid is highly infective, even after dilution. The diluted fluid may be filtered through a Berkefeld filter, and *the filtrate is still infective*—that is to say, the micro-organism is so minute that it can pass through the pores of a Berkefeld filter. Durham also isolated from the dejecta of cases of "Asylums dysentery" (ulcerative colitis) a micrococcus which would pass through the pores of a Berkefeld filter.* Marx and Stricker have shown that an emulsion of the tissues of the *Molluscum contagiosum* of birds is infective even when filtered through a Berkefeld filter, but becomes non-infective after filtration through a Chamberland F.

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* *Archives of Neurology*, vol. i.

Reed and Carroll have carried out an experiment* with yellow fever which suggests that the microbe of this disease belongs to the category of invisible organisms. They filtered the blood-serum of patients suffering from yellow fever, and obtained during the infective stage, through a Chamberland F filter, and found the filtrate to be infective. Perhaps the most remarkable experiment indicating a microbe of excessive minuteness has been performed by Professor MacFadyean of the Royal Veterinary College, London. He found that the blood from a case of the Cape horse sickness was still infective after filtration through a Chamberland F. Not only was this so, but the blood could be filtered through a Chamberland B, the pores of which are much finer than those of the Chamberland F., and would still infect a horse inoculated with the filtrate.†

An organism which will *just* pass through a Berkefeld filter is probably distinctly visible; one which will *just* pass through a Chamberland F might be visible with the best optical appliances and skilful manipulation; but one which will pass easily through the Chamberland F, or which will pass through the Chamberland B, is certainly not visible.

Is there any hope that these organisms will be rendered visible? Not unless some new principle is discovered for the construction of the optical parts of the microscope. In the present day mechanical skill has actually practically attained the limit imposed by mathematical theory.

Recently Siedentopf and Zsigmondy‡ have indicated a method whereby these ultra-microscopic particles may be rendered visible as a diffraction disc by certain methods of illumination, and that is all we can hope to see. By photography also it may be possible to obtain an image of particles which are beyond the limits of human vision.

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* *American Medicine*, February 22, 1902.

† *Journ. Comp. Pathology and Therapeutics*, xiii., 1900, p. 1.

‡ See *Nature*, February 19, 1903, p. 380.

II.

BACTERIOLOGY FOR GENERAL PRACTITIONERS AND JUNIOR MEDICAL OFFICERS OF HEALTH.

BY

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(*Continued from page* 290.)

Beginners often have some difficulty in focussing the organism, but in the method of preparing the mounts as above given there are certain to be a few blood corpuscles in the field, which will assist the observer in getting the former into focus.

At first one finds the bacilli in a very active condition, the numerous short ones darting hither and thither, and the fewer but longer forms twirling, rolling, or moving across the field in a slow, serpentine manner. In a few minutes one will notice that twos and threes of the bacilli seem to be catching on to one another, and that still later these small lots are themselves joining to form larger collections. At the same time we will notice that the motility of the organisms is being reduced, until in probably about twenty minutes we find that motion is only confined to a few solitary bacilli, and that the masses of organisms have become agglutinated, until we have only a few large-sized "*clumps*" formed, somewhat resembling a bundle of dried twigs. Here and there an individual bacillus may be noticed, with its head apparently entangled in the edge of the clump, and feebly and spasmodically flourishing its tail, the vibration thereby caused giving the appearance, as it were, of the whole "clump" moving. This "*clumping*" *and loss of motility* in the bacilli (if the blood-serum is derived from an undoubted case of typhoid fever) will take place *within half an hour*, and very often in half that time, giving what is known as a "*positive reaction.*" If there is no "clumping" within one hour, the reaction is "*negative,*" and we are most likely not dealing with a case of enterica. If a much lower dilution is required to cause clumping—say 1 in

5 or 1 in 10—such a reaction is of little value as a "positive" diagnosis, for the blood of some people in health causes this; but when a 1 in 30 dilution is negative and a 1 in 5 dilution is so also, then the latter test is of corroborative value as regards the former—that we are not dealing with a case of typhoid, or if so, it may be that the blood has been taken at too early a stage of the disease to react, and in the continuance of the illness it would then be advisable to have a fresh sample taken in two or three days' time. In like manner, to corroborate a positive reaction with the 1 in 30, we may apply the test to a 1 in 60 or a 1 in 100 dilution.

It must also be remembered that in some instances a positive reaction can be obtained months, and even, it is said, years, after the illness. This may sometimes mislead an observer who is not aware of a patient's previous history as regards subsequent illness, as for example, in influenza. The history of each case is therefore of great assistance in coming to a conclusion, enabling one to exclude cases which later on prove to be other diseases, such as phthisis, meningitis, or appendicitis. The test is a most useful one, and should be made in every doubtful case after six or seven days' illness. It is not difficult to perform, the only trouble being in getting and maintaining a reliable stock culture; and although the method I have described as regards the process of dilution is not strictly accurate, the results in my experience warrant the use of so simple a procedure.

The *pyogenic* or pus-forming organisms which the general practitioner may meet with are *Staphylococcus pyogenes aureus* and *albus*, *Streptococcus pyogenes*, *Pneumococcus*, and *Gonococcus*.

"STAPHYLOCOCCUS PYOGENES AUREUS" (OGSTON).—This organism occurs very generally in nature, being present in earth, water, air, but more especially on the surface of the skin, and in most suppurative processes. Inoculate by "stab" a gelatine tube with pus, or with a sterilized needle passed through between a couple of the teeth, or rubbed between the fingers; incubate at room temperature (gelatine melts if exposed to a temperature of 24° C. [75° F.]). In twenty-four hours the streak will show numerous tiny whitish colonies, and the gelatine will begin to liquefy at the

top, whilst in another twenty-four hours liquefaction will be apparent along the whole length of the stab, and forming a cupped appearance on the surface of the gelatine; later on the whole of the gelatine will be liquefied, and the yellowish growth itself will settle to the bottom of the tube. If the inoculation is made on the *surface* of agar or blood-serum, and incubation carried on at 37° C. for two or three days or longer, a beautiful copious yellow growth takes place, something like a streak of yellow paint, but more marked if exposed to diffused light; and as no liquefaction of these media occurs, the cultures can be kept for a long period, until, in fact, the organism grows right through the culture. It also forms a copious yellow growth if inoculated on the surface of a sterile boiled potato.

"STREPTOCOCCUS PYOGENES" is frequently found in films prepared from diphtheritic and scarlatinal throats, and from erysipelatous and suppurative processes. Milk from an inflamed mamma very often contains the organism. It is much more delicate than the staphylococcus, and is by no means easy either to isolate or to cultivate. As a stab culture in gelatine, it slowly forms tiny pin-head colonies, which do not grow together nor liquefy the medium like the former coccus. It shows no growth on potato. Micro-preparations of both of these organisms are prepared by spreading a thin layer (as thin as possible with the former) on a cover-slip, and after drying and fixing are readily stained by any of the aniline stains, carbol-thionin blue being, perhaps, one of the best. They are both stained by Gram's method. Under the oil-immersion lens staphylococci show numerous masses of spherical cocci arranged in grapelike clusters (σταφυλίς, a bunch of grapes), but with no special arrangement, whilst in the case of streptococci we find the same, or rather larger, cocci having a definite arrangement of the units in the form of chains, in some cases short (*S. brevis*), in others long (*S. longus*).

The different forms of streptococci, including that of erysipelas, are said by bacteriologists to be all of one species, the latter disease being simply a more virulent form of infection. If such is the case, an explanation is necessary as regards the opposite results one finds in using antistreptococcic serum. In cases of

erysipelas and septicæmia I have seen this serum act promptly and with the same good results one expects with diphtheria antitoxin, whilst in other cases of the same disease—and to all appearance pathogenically and pyogenically alike—a similar brand of serum has had no effect, or, at all events, no marked antitoxic effect. From such results one is inclined to believe that there must be distinctive species of streptococci, and that the disease originated by each one is only antagonized by a serum prepared from a *similar* species of organism. Dr. Houston claims that the scarlatinal streptococcus is a distinct organism apart from others. That being the case, it is surely an error to treat scarlet-fever patients with serum prepared from any other species of organism than the one causing the disease, and similarly as regards erysipelas or septicæmia.

PNEUMOCOCCUS (FRAENKEL).—This organism can usually be found in the glairy, rusty sputum of croupous pneumonia in the acute stage. It is also said to be the cause of ulcerative endocarditis, pericarditis, and meningitis. In fatal cases of the latter disease I have obtained typical specimens of the organism from the submeningeal tissues. The coccus is not easily isolated for cultivation, but film preparations are readily stained with the aniline dyes, such as carbol-thionin or carbol-fuchsin. It is stained by Gram's method, which is one of the means of distinguishing it from Friedländer's pneumo-bacillus, which is also found in pneumonia, though not so generally as the diplococcus of Fraenkel, but which is *not* stained by Gram's process.

Under the microscope the organisms appear as small oval diplococci—*i.e.*, they occur in pairs. The free ends of the cocci are often somewhat pointed and their adjacent ends flattened, giving a sort of spear-head appearance, though when grown on solid media they may be more rounded. The diplococci are surrounded by a capsule, which, however, is not apparent unless fixed and stained in a special manner, or only as a faint shading.

GONOCOCCUS (NEISSER).—This organism, which is present in the purulent discharge of gonorrhœa, especially in the *early* stage, is not easily cultivated, but a film preparation prepared by spreading a thin layer of the pus on a cover-slip, drying and fixing

as usual, is readily stained by the aniline dyes, such as methylene blue or thionin blue. It is decolourized by Gram's method, which distinguishes the organism from other cocci which may also be present. Microscopically, the small cocci are seen in pairs (diplococci), with a small space between, sometimes compared to the appearance seen when two beams lie with their concave edges facing each other. The cocci are chiefly *intracellular—i.e.*, are actually within the pus cells—though others are generally found lying free.

In all these processes it must be remembered that we are dealing with living organisms, and that precautions must be used to prevent infection of ourselves or others by destroying all infective matter, either by means of heat or strong bactericides, such as a 1 in 500 solution of the biniodide of mercury. No infective matter should be left lying about. If it is desired to preserve cultures the best method is to dip the end of the wool-plug in formalin, press it well into the tube, and cover the top with sealing-wax. Formalin is a most powerful bactericide, and has the advantage of hardening the culture medium, especially gelatine, which permits of the tubes being more freely handled. Tubes dealt with in this way can be kept for years with little alteration in the appearance of the growth.

Blood.—To examine blood bacteriologically a thin layer of the specimen should be spread on a very clean cover-glass, allowed to dry in the air, or, better still, in a hot oven, for two or three hours, and then fixed by passing thrice through a flame; but if kept at a temperature of 115° C. in the oven for two hours, flame fixing is unnecessary. The slip should then be immersed in a dilute solution of acetic acid (1 per cent.), in order to decolourize the red blood cells, next washed very thoroughly in water, *and stained by* thionin blue, carbol-fuchsin, or by Gram's method. The blood cells may be counterstained by eosin.

Pus.—A specimen of pus for examination may, if necessary, be withdrawn from the cavity (*e.g.*, the pleural) by means of a sterile needle. Gelatine and agar tubes may be inoculated, or films at once prepared and stained by methylene blue, thionin blue, or by Gram's differentiating method. By this means staphylococci,

streptococci, pneumococci, or other organisms may be found. In most cases of empyema in adults streptococci are present.

MILK.—For a reliable examination of milk the centrifuge is necessary, though the simpler method may be tried of allowing the milk to settle in a conical glass for twenty-four hours and examining the sediment. The film should be stained by thionin blue, to which has been added 2 or 3 drops of chloroform, and the latter removed after staining from three to five minutes by pouring off the surplus stain and waving the slip, held in the fingers, over a flame, thereafter washing well in water, drying and mounting. Such a crude method will demonstrate streptococci or staphylococci, but for tubercle carbol-fuchsin stain must be used, though without centrifuging one is not likely to find this bacillus.

NOTICE TO FELLOWS AND MEMBERS.

THE notice of Fellows and Members is called to the enclosed forms relative to the Liverpool Congress.

It is earnestly requested that the form intimating the intention of Fellows to be present should be filled up and forwarded at once to the Hon. Secretary, Municipal Buildings, Liverpool.

The railway certificate should be kept and presented at the booking-office, with the view of securing the authorized reduction in the fare.

CHEMICAL NOTES.

PHOSPHORUS IN FLOURS. BALLAND. (*Comptes Rend.*, 136, [5], 332, 333.)—It is known that the determination of phosphorus in the ash of vegetable substances does not give all that present in the original substance, as some occurs in the form of an organic compound, and escapes during the incineration. The author has determined the phosphorus in a number of flours directly by a method he proposes to describe later. His results, expressed as grammes of phosphorus and of phosphoric oxide per kilogramme of bread (containing 35 per cent. of water), are as follows:

	P.	P_2O_5.
Military bread, with 80 per cent. bolted flour	1·04	2·47
,, ,, 70 ,, ,,	0·91	2·16
Bread from the Paris Civil Hospitals ...	0·85	1·95
,, civil bakeries	0·53 to 0·78	1·23 to 1·82

Similar results have been obtained for nitrogen; the two sets of figures indicate the gradual diminution of the amount of gluten in the flour. The author attributes this to the system of milling with cylinders, and to the increasing perfection of bolting machinery.

BACTERICIDAL ACTION OF PERFUMES. H. MARX. (*Centralbl. Bakteriol.*, 1903, [1], 33, 74; *Chem. Zeit.*, 1903, 27, [11], Rep. 28.)—Experiments have been made by the author on the action of various perfumes on cultivations of *Bacillus anthracis* and *Staphylococcus pyogenes aureus*. Growth is prevented by the presence in the culture medium of terpineol or nitrobenzene in the proportions 1:1,000 or 1:100 respectively, while agar plates are completely or partially sterilized if a drop of terpineol or nitrobenzene is added, or if they are partly covered with heliotropin or vanillin. Even a relatively short treatment with terpineol (1:500) or nitrobenzene (1:10) produces such a change in these bacteria that afterwards they develop only slowly.

Anthrax or staphylococci are killed in sixty minutes by terpineol in the concentrations of 1 : 100 and 1 : 10 respectively, whilst nitrobenzene, even in a concentration of 1 : 10, kills neither of these organisms in twenty-four hours. An especially strong action is exerted by terpineol in combination with a foaming potash soap. In emulsions of bacteria, perfumes—particularly terpineol—effect agglutination, but it is doubtful whether this plays a part in the bactericidal action. The author considers rather that the latter is connected with the property of rendering oxygen active.

Determination of Hardness of Water. W. Peters. (*Apoth. Zeit.*, 1903, 18, 25. *Chem. Zeit.*, 1903, 27, [11], Rep. 21.) —For the determination of the hardness of waters containing, besides calcium salts, larger quantities of magnesium salts—as is the case with river-water into which the waste-water from potassium chloride factories is led—the author recommends the following method: 100 c.c. of the water containing a few drops of alizarin solution are titrated at 100° C. with decinormal hydrochloric acid until the red colour of the liquid changes to yellow, and remains so after continued boiling. Multiplication of the number of c.c. of acid used by 2·8 gives the degrees of temporary hardness on the German scale, since 1 c.c. of decinormal acid corresponds with 2·8 milligrammes of CaO. A known volume, in excess, of a mixture of equal proportions of decinormal sodium carbonate and decinormal sodium hydroxide solutions is then added, the liquid being then boiled for a few minutes and afterwards cooled to 15° C., and made up to 200 c.c. The excess of alkali is then measured by titrating 100 c.c. of the filtered liquid with decinormal hydrochloric acid, using methyl orange as indicator. By multiplying by 2·8 the number of c.c. of decinormal alkali, calculated on 200 c.c. of the filtrate used, the total hardness of the water is obtained in German degrees.

Manufacture of Clarified Margarine. P. Pollatschek. (*Chem. Rev. Fett. u. Harz-Ind.*, 1903, 10, [3], 53-54.)—The clarified butter-fat of commerce consists of the fat separated by melting from the water and casein. A clarified margarine is now exten-

sively used in Central and South Germany. This is prepared from the finished margarine in the same way as the butter-fat, though it is often frequently obtained by churning the fat with milk, and then (without cooling with ice) pumping the mixture into the melting vessel, where the fat is again separated. The latter process, though cheaper, yields a product of inferior flavour and aroma. Margarine prepared with kephir milk gives a butter-fat of excellent aroma. Margarine fat is also manufactured without the use of milk by simply adding the volatile flavouring and aromatic compounds (aldehydes, etc.) to the melted fat.

The fats chiefly used in the manufacture are "premier jus" lard, cocoanut oil, cotton-seed oil and cotton-seed stearine, and sesamé and earthnut oils.

THE CAUSSE TESTS FOR WATER POLLUTION. S. RIDEAL. (*Journ. San. Inst.*, 1902, 23, [4], 505-507.)—The author, after a careful investigation of Causse's "crystal violet" test (*Journ. Soc. Chem. Ind.*, 1902, 642), has come to the conclusion that it is valueless for determining the purity of a water. A solution made by dissolving methyl violet in water saturated with sulphurous acid, according to directions, gave no colour with a number of pure waters, including some specially prepared by distillation with alkaline and acid permanganate, then with ignited baryta, and finally alone. Excess of sulphurous acid was then removed by passing carbon dioxide through for four hours, when only a little sulphurous acid remained, the liquid still being colourless. On adding this to different waters of known quality, the results did not in the least agree with Causse's contention. Some pure deep-well waters gave a strong reaction at once, but no colour was obtained with ordinary distilled water, nor with water purified as above. Moreover, waters known to be polluted gave an immediate colour, as did also distilled water containing 4 parts per 100,000 of caustic soda or ammonia, while, on standing in a half-filled bottle for some hours, the tint developed in all cases without any addition. The coloration, therefore, seemed to be due to loss of free sulphurous acid by oxidation or neutralization, rather than to the purity of a water.

Characteristic Reaction for Pure Water. Brand. (*Zeits. Ges. Brau.*, 26, [6], 91-92.)—H. Causse (*Journ. Soc. Chem. Ind.*, 1902, 642) recently proposed the use of hexamethyltriaminotriphenylcarbinol (crystal violet) for testing the purity of water, the reagent being prepared by dissolving 0·25 gramme in 250 c.c. of cold water saturated with sulphuric dioxide. In contact with pure water this reagent is said to produce a violet ring, afterwards extending throughout the liquid and increasing in depth of colour, when warmed, to 35° to 40° C.

The author, however, finds that the reagent furnishes the same reaction with water containing 1 per cent. of urine, and is, therefore, unreliable; whereas Griess's reagent (paradiazobenzene sulphate) will reveal 1 part of horse urine in 50,000 of water.

Recent Developments of Water Sterilization by Means of Ozone. B. Proskauer. (*Biochem. Centr.*, 1903, 1, [6], 209-213.) —After Fröhlich had devised the means of preparing ozone from the air in concentrated form (*Journ. Soc. Chem. Ind.*, 1895, 164), installations for the treatment of their water-supply were erected by different towns. The apparatus invented by Otto (*Journ. Soc. Chem. Ind.*, 1897, 1082) was investigated by Loir and Fernbach, and is stated to have given good results in practice. The first installation on a large scale, at Blankenberghe, in Belgium, was capable of sterilizing 2,000 cubic metres of water per day, but as the results in practice did not come up to expectation, it was soon abandoned.

The plant erected by Abraham and Marmier at Lille (*Journ. Soc. Chem. Ind.*, 1899, 1148) was found by a Commission presided over by Calmette to be capable of sterilizing 35 cubic metres of water per hour, even the spores of *Bacillus subtilis* being destroyed; for reasons unknown to the author it also has been abandoned. Another installation still at work at Schiedam, near Rotterdam, is stated to furnish 20 cubic metres of sterilized water per hour.

A plant, capable of sterilizing 10 cubic metres of water per hour, was constructed by Siemens and Halske for Martikenfelde, Berlin. This was tested by Ohlmüller and Prall, who infected the Spree water with cholera vibrios and typhus bacilli prior to ozonization, and found that these micro-organisms were com-

pletely destroyed by the process. They also came to the following conclusions: (1) The treatment of water with ozone gives much better results as regards the removal of bacteria than sand filtration. (2) The chemical characteristics of the water are only affected to the extent that the oxygen absorption is reduced and the free oxygen increased. (3) The ozone dissolved by the water is rapidly transformed into oxygen, and is thus without influence on health. (4) Colouring matters are destroyed. (5) No foreign taste or odour is introduced.

The author's experiments with this process gave unfavourable results so long as the sterilizing tower contained the original large-sized packing used by Weyl and by Ohlmüller and Prall in their experiments, but, by using fine granular packing, pathogenic bacteria were invariably destroyed. He found that in the Martikenfelde plant such organisms in the water were killed by the passage of 25 cubic metres of air containing 3·4 to 4 grammes of ozone per cubic metre, the rate of passage of the water being 1 cubic metre in 8½ to 9 minutes. The oxygen absorption of the water was reduced by 0·05 to 0·92 milligramme, and in one case by 2·24 milligrammes, per litre.

The author confirms the statement of Ohlmüller and Erlwein that the oxygen absorption of the water must be taken into account. Thus, in the Wiesbaden ozonizing plant only 0·9 to 1·8 grammes of ozone per cubic metre of air is required to effect the same results on water with an oxygen absorption of 1·7 milligrammes per litre as require an ozone concentration of 3·4 to 4 grammes per cubic metre of air in the case of the Martikenfelde plant, where the oxygen absorption of the water ranges from 4·6 to 0·08 milligrammes per litre.

The Wiesbaden plant is the first large installation of the kind in Germany. A smaller one just completed at Paderborn yields 50 to 60 cubic metres of potable well-water per hour (*Journ. Soc. Chem. Ind.*, 1890, 851; 1897, 765).

Action of Zinc on Microbes in Water. F. Dievert. (*Comptes Rend.*, 136, [11], 707-708.)—When granulated zinc is agitated with water containing microbes, especially *Bacillus Eberthi* and *B. coli communis*, the water is sterilized after a few hours, even with

5 grammes of zinc to the litre of water. Further experiments showed that the minute quantity of dissolved zinc oxide formed is not the active agent, though it probably causes the microbes, when left at rest, to collect at the bottom of the vessel; but the microbes actually corrode and consume the zinc, by which they appear to be poisoned.

TRACES OF DIAMINOPHENOL AS A REAGENT FOR AMMONIA IN WATER. MANGET and MARION. (*Ann. de Chim. Anal.*, 8, [3], 83.)—Diaminophenol, known commercially as "amidol," affords a very sensitive reagent for the detection of free ammonia, so that its solution may be usefully substituted for Nessler's reagent for the colorimetric determination of ammonia in drinking-water. It is said to be definitely more sensitive than Nessler's reagent, the tint given by a dilution of free ammonia 1 : 1,000,000 being very marked, and the colour reaction distinct in even higher dilution.

QUALITATIVE SEPARATION OF ARSENIC, ANTIMONY, AND TIN. J. WALKER. (*Proc. Chem. Soc.*, No. 258, December 17, 1902.)—The solution containing the mixed sodium thio-salts of arsenic, antimony, and tin is heated with sodium peroxide, and from the resulting solution of sodium arsenate, antimoniate, and stannate, tin is precipitated as stannic hydroxide by boiling with excess of ammonium chloride. After the addition of excess of acid, antimony sulphide is thrown down by hydrogen sulphide in the cold, leaving arsenic in solution.

TEA FERMENTATION. G. WAHGEL. (*Chem. Zeit.*, 1903, 27 [24], 280-281.)—On soaking black China tea in just enough sterilized water in a test-tube to give a solution of about the same concentration as the sap of the withered tea-leaf, and keeping the liquid at 27 to 30° C. for three to five days, the author finds that a growth of a certain yeast is obtained. The more expensive teas yielded this yeast alone, and the liquid assumed a pleasant and fairly strong tea aroma; the cheaper kinds, however, gave few yeast cells, but many rod bacteria, of which as many as three kinds were observed in some instances. Indian and Ceylon teas, which are dried at a much higher temperature, and much

more completely than the Chinese, contain no micro-organisms. Caucasian tea yields fairly large rods. The author considers it possible, by means of pure cultures of the above-mentioned yeast, to produce in the Caucasus and in Ceylon tea having the aroma of China tea.

Occurrence of Salicylic Acid in Fruits. F. W. Traphagen and E. Burke. (*Journ. Amer. Chem. Soc.*, 1902, 25 [3], 242-244.) —The occurrence of salicylic acid as a normal constituent of strawberries was recorded by Portes and Desmoulière (*Journ. Soc. Chem. Ind.*, 1901, 1,229), and the latter authority has more recently detected it in raspberries, mulberries, and liquorice-root. The authors have examined various fresh fruits at the Montana Experiment Station, and have found that salicylic acid is almost invariably present in a minute proportion. Thus, they have detected it in strawberries, raspberries, blackberries, currants, plums, black cherries, apricots, peaches, grapes, crab-apples, apples, and oranges.

In some cases comparative quantitative tests were made by distilling the fruit with phosphoric acid, and extracting the salicylic acid with ether, with the following results: Currants, 0·57; cherries, 0·40; plums, 0·28; crab-apples, 0·24; and grapes, 0·32 milligramme per kilo. It was found, however, by check analyses that the whole of the salicylic acid was not extracted from the fruit by this method. The reaction for salicylic acid was also given by tomatoes, cauliflowers, and string beans.

Lead Poisoning and Water-Supplies. Report to the Local Government Board by Dr. Houston, the Public Health Engineer, March 14, 1903, 275. (See Ackroyd, *Journ. Soc. Chem. Ind.*, 1900, 1,130.)—Owing to the prevalence of lead-poisoning, attributable to water-supplies derived from moorland sources, a comprehensive investigation was made as to the ability of such moorland waters to act upon lead. The ratio between the degree of acidity and the plumbo-solvent power does not appear to be the same for all peaty waters, particular waters having, within limits, their own standards in this respect. Certain spring waters have the power of neutralizing the acid of peaty water, so that a water of mixed

origin may remain without action upon lead. In the case of a water-supply habitually acid or liable to become acid, a process of neutralization may be carried out, the most effective method being ordinary sand filtration, with the addition of some neutralizing agent—*e.g.*, a thin coating of lime on the surface of the sand, with limestone under the sand—to the filter, and the subsequent addition of a trace of sodium carbonate to the neutral filtered water.

SEPARATION AND DETERMINATION OF CAFFEINE AND THEOBROMINE. H. BRUNNER and H. LEINS. (*Zeits. anal. Chem.*, 1903, 42 [2], 117-118.) The substance, such as coffee, kola, cocoa, or maté, is boiled for thirty minutes, with 500 c.c. of water, under a reflux condenser. The solution is then precipitated with freshly-prepared lead hydroxide until colourless, heated again to boiling for fifteen minutes, and filtered. The residue is washed twice with 500 c.c. of water, the filtrate and washings being reduced by evaporation to a volume of 500 c.c. Carbon dioxide is led through the boiling solution, the precipitated lead carbonate is filtered off, and the filtrate evaporated on the water-bath, after adding some quartz-sand. The residue obtained is extracted for eight hours with ether in a Soxhlet apparatus. After distilling off the ether, the residue is boiled out three times with 50 c.c. of water, and filtered, when cooled, to 50° C. On evaporating and drying at 80° C., the two alkaloids are obtained as a white ash-free product.

Separation.—The mixed alkaloids are dissolved in hot water, precipitated with silver nitrate, the precipitate redissolved in 2 to 3 c.c. of ammonia, and the solution warmed to expel the latter, dust and a strong light being avoided. After cooling to 30° C., the precipitated silver-theobromine is collected on a weighed filter, washed, and dried at 100° C. The substance has the formula $C_7H_7AgN_4O_2$.

The filtrate is treated with sodium chloride, filtered, and evaporated on the water-bath. The caffeine is extracted from the residue with ether, the latter is evaporated, and the alkaloid dried at 100° C., and weighed.

THE ROYAL INSTITUTE OF PUBLIC HEALTH.

LIVERPOOL CONGRESS.

Wednesday, July 15, *to Tuesday, July* 21, 1903.

IN UNIVERSITY COLLEGE, LIVERPOOL.

Patron.

HIS MAJESTY KING EDWARD VII.

Vice-Patron.

H.R.H. THE PRINCE OF WALES, K.G.

President of the Congress.

THE RIGHT HON. THE EARL OF DERBY, K.G., G.C.B.

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Vice-Presidents of the Congress.

The Right Hon. the Earl of Sefton.
The Right Rev. the Lord Bishop of Liverpool.
The Right Rev. the Lord Bishop of Crediton.
The Right Rev. Bishop Whiteside.
The Most Rev. the Chief Rabbi.
The Most Rev. the Greek Archimandrite.
The Right Hon. the Lord Mayor of Dublin.
The Right Hon. the Lord Provost of Edinburgh.
The Hon. the Lord Provost of Aberdeen.
The Hon. the Lord Provost of Glasgow.
The Right Worshipful the Mayor of Birkenhead.
The Right Worshipful the Mayor of Blackpool.
The Right Worshipful the Mayor of Bootle.
The Right Worshipful the Mayor of Chester.
The Right Worshipful the Mayor of Eastbourne.
The Right Worshipful the Mayor of Exeter.
The Right Worshipful the Mayor of Southport.
The Right Worshipful the Mayor of St. Helens.
The Right Worshipful the Mayor of Warrington.
The Chairman of the Cheshire County Council (Colonel George Dixon, J.P.).
The Chairman of the Lancashire County Council (the Right Hon. Sir J. T. Hibbert, K.C.B.).
The Chairman of the Mersey Docks and Harbour Board (Robert Gladstone, Esq.).
R. P. Houston, Esq., M.P.
Sir Elliot Lees, Bart., M.P., D.S.O.
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Alderman M. Hyslop Maxwell, junr., J.P.
Alderman T. Menlove, J.P.
W. Oulton, Esq., C.C., J.P.
Alderman C. Petrie.
Alderman W. Roberts.
Alderman E. Walker, J.P.
Rev. T. W. M. Lund.

SECTIONS.

1.—Sanitation of Congested Areas and Rehousing the Dispossessed.

President.

Austin Taylor, Esq., M.P., C.C.

Vice-Presidents.

C. H. Tattersall, Esq., L.R.C.P.
James Niven, Esq., M.A., M.B.
R. S. Marsden, Esq., M.B., D.Sc.

Secretary.

F. T. Turton, Esq., Deputy Surveyor, Municipal Offices, Liverpool.

Address by Mr. Austin Taylor, M.P.

A discussion on the various methods employed in towns for dealing with Insanitary Areas will be taken part in by representatives of towns where these operations have been most active.

By kind invitation of Mr. Lever, members interested will be

invited to luncheon at Port Sunlight, and will have an opportunity of fully inspecting the model village and the various works in connection with Port Sunlight.

2.—PREVENTIVE MEDICINE AND VITAL STATISTICS.

President.

J. Spottiswoode Cameron, Esq., M.D., B.Sc., Medical Officer of Health for Leeds.

Vice-Presidents.

Sir Charles A. Cameron, C.B., M.D.
Sir Michael Foster, M.D., M.P., F.R.S.
A. K. Chalmers, Esq., M.D., D.P.H.
E. W. Hope, Esq., M.D., D.Sc.
E. Sergeant, Esq., M.R.C.S., L.R.C.P.
F. Vacher, Esq., F.R.C.S., M.R.C.P. Edin.
J. B. Russell, Esq., M.D., LL.D.

Secretaries.

A. A. Mussen, Esq., M.D., D.P.H., Municipal Offices, Liverpool.
H. S. Willson, Esq., M.B., King's College, London, W.C.

Subjects for discussion :

"Preventive Measures against Tuberculosis in Large Towns," by Dr. N. Raw.

"The Supply of Humanized Sterilized Milk for Infants," by Dr. A. A. Mussen.

"The Transmissibility of Infectious Diseases during the Incubation Period," by Dr. H. S. Willson.

"Infectious Hospitals and 'Return' Cases," by Professor W. R. Simpson, M.D., F.R.C.P.

"Emergency Hospital Construction and Accommodation." Paper by Mr. Shelmerdine.

"Requirements in Regard to Underground Bakehouses." Paper by Dr. W. N. Barlow.

Special subjects for discussion :

"Underground Bakehouses." Speakers—Councillor J. Tousley, J.P., Alderman Bowkett, and A. W. Last, Esq.

"Tubercular Disease among Domestic Cattle."

"Temporary Buildings for Consumptive Sanatoria."

"The Personal Hygiene of Consumptives."

"The Prevention of Small-Pox."

3.—Bacteriology and Comparative Pathology.

President.

Professor Rubert Boyce, M.B., F.R.S.

Vice-Presidents.

Professor G. Sims Woodhead, M.A., M.D., F.R.S. Edin.
Professor Sheridan Delépine, M.B.
S. Moncton Copeman, Esq., M.D., F.R.S.
R. S. Reynolds, Esq., M.R.C.V.S.

Secretaries.

Professor R. T. Hewlett, M.D., M.R.C.P., King's College, London.
H. E. Annett, Esq., M.D., D.P.H., University College, Liverpool.
T. Eaton Jones, Esq., Municipal Offices, Liverpool.

Subjects for discussion:

Papers by Professor Rubert Boyce, F.R.S.; Professor Dunston, M.R.C.V.S.; Professor Young, F.R.C.V.S.

"The Standardization of Drugs," by R. Lord, Esq., M.D.

"Diseases of Animals conveyed by Milk."

"Tuberculosis in Cattle."

4.—Tropical Sanitation.

President.

Professor Nocht, M.D., Hamburg.

Vice-Presidents.

Major Ronald Ross, C.B., F.R.S.
Colonel Crombie, C.B.

Secretaries.

J. W. W. Stephens, Esq., University, Liverpool.
James Cantlie, Esq., M.B., F.R.C.S., 46, Devonshire Street, London, W.

Subjects for discussion:

"Tropical Sanitation on Ships," by Dr. Evans, of the Elder, Dempster line.

"Beri-Beri."

And a paper by James Cantlie, Esq., M.B., F.R.C.S.

5.—Municipal Hygiene and Sanitary Legislation.

President.

Sir John Brunner, Bart., M.P.

Vice-Presidents.

Alderman T. Menlove, J.P.
Alderman W. J. Burgess, J.P.
Alderman J. Ball, J.P.
Alderman W. Roberts.
Alderman H. Campbell, J.P.
J. R. Grant, Esq., C.C.
A. Shelmerdine, Esq., C.C.
The Right Worshipful the Mayor of Fulham.
The Right Worshipful the Mayor of Holborn.
The Right Worshipful the Mayor of Southwark.

Secretary.

E. W. Pierce, Esq., Deputy Town Clerk, Municipal Offices, Liverpool.

Subjects for discussion:

"The Provision of Sanitoria for Consumptives."

"Water-Supply," by Mr. Joseph Parry.

"Administration of the Vaccination Acts," by Mr. Moulding.

"The Notification of Tuberculosis."

"Inspection of Cattle for the Purpose of discovering Diseases likely to Affect Milk."

"The Influence upon Public Health of the Present Method of Keeping Horses and Cattle in Towns," by Mr. Eaton Jones, Mr. Stafford Jackson, and others.

"Recent Sanitary Legislation," E. W. Pierce, Esq.

"Sanitation of Cowsheds."

"The System of Sanitary Certificates and Sanitary Authorities."

6.—Engineering.

President.

G. F. Deacon, Esq.

Vice-Presidents.

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H. P. Boulnois, Esq.
A. B. Holmes, Esq.

Secretary.

J. A. Brodie, Esq., City Engineer, Municipal Offices, Liverpool.

Address by President.

Subjects for discussion:

"Sewage Effluence and the Construction of Filter-beds," by Professor Rubert Boyce, M.B., F.R.S.

"The Disposal of Town Refuse," by Professor Antony Roche, F.R.C.P.I.

"Past and Present Modes of Collecting House Refuse," by F. W. Bowden, Esq., Assoc.M.Inst.C.E.

"Construction and Maintenance of Carriage Ways," by F. E. Cooper, Esq., Assoc.M.Inst.C.E.

"Road Construction and Maintenance," by Hector F. Gullan, Esq., Assoc.M.Inst.C.E.

"Mechanical Road Vehicles for Public Works," by T. Molyneux, Esq.

"Traction on Road Surfaces," by Professor H. S. Hele-Shaw, LL.D., F.R.S., M.Inst.C.E.

"Utilization of Destructor Products," by J. A. Brodie, Esq., M.Inst.C.E.

7.—Child Study and School Health.

President.

Professor C. Sherrington, M.A., M.D., F.R.S.

Vice-Presidents.

Principal Dale.
Rev. W. J. Adams.
Rev. J. W. Bell-Cox.
Rev. R. M. Ainslie.
W. Oulton, Esq., C.C.
Edgar Browne, Esq., F.R.C.S. Edin.
Miss Elfrida Rathbone.

Secretary.

J. Hay, Esq., M.D., 7, Rodney Street, Liverpool.

Subjects for discussion :

"Child Study: its Scope and Method in Education," by Mr. H. Holman.

"Dental Hygiene," by Norman Bennett, M.A., M.B.

"Mental Deficiency in Relation to Speech Defect," by Dr. Ashby and Miss James.

"Military Drill," by Mr. Fred Andrews.

"Care of the Eyes of School Children."

"Teaching of Hygiene in Elementary Schools.

8.—Port Sanitary Administration.

President.

Alderman Thomas Clarke, M.D.

Vice-Presidents.

Alderman Barnett, Bristol.
,, Fraser, Hull.
,, Jacobs, Cardiff.
Councillor Tutton, Swansea.
Alderman Giles, J.P., Liverpool.

Secretaries.

J. W. Mason, Esq., M.B., D.P.H., Town Hall, Hull.
W. Hanna, Esq., M.A., M.B., D.P.H., Port of Liverpool.

Address by the President.

Subjects for discussion :

"Food Inspection," by Dr. Williams, Port of London.

"The Emigration Trade."

"Ship Sanitation."

"Orders of the Local Government Board and Small-Pox."

Dr. N. E. Roberts will read a paper.

"A Plea for Community of Action among Port Sanitary Authorities," by Dr. Pringle.

"Supervision of Small-pox Contacts," by Dr. Knight.

9.—Ladies' Committee and Section of Domestic Sanitation.

President.

Mrs. Alfred Booth.

Vice-Presidents.

Mrs. Boulnois.	Lady Brunner.
Miss Bowring.	Mrs. Chevasse.
Miss F. Calder.	Mrs. Dale.
The Lady Mayoress.	Mrs. George Holt.
Lady Mitchell Banks.	

And the members of the Ladies' Sanitary Association.

Secretaries.

Mrs. Topham Steele, 31, Princes Avenue.	Mrs. Yates, Ivanhoe Road, Liverpool.

Subjects for discussion:

"Elementary School Hygiene," by Mrs. Boulnois, Mr. Legge, Inspector of Reformatory Schools, and Miss Rathbone.

"Anti-Faddism," by Dr. Helen Boyle, Dr. Schofield and Dr. Stookes.

"Sterilized Milk and the Care and Feeding of Infants," by Miss Heald, Dr. Hunter, and others.

"District Nursing," by Miss Hughes.

Mrs. Oesterberg will arrange a display of physical exercises by her pupils.

PROVISIONAL DAILY PROGRAMME.

Wednesday, July 15.

8 p.m.—Opening address by The Right Hon. the Earl of Derby, K.G., G.C.B.

Presentation of the Harben Medals for the years 1901 and 1902 to Sir Charles A. Cameron, C.B., M.D., F.R.C.P. Irel., and Professor William R. Smith, M.D., D.Sc.

(Delegates and members are requested to wear municipal or academic robes.)

THURSDAY, JULY 16.

10 a.m.—Opening of the several sections.
8 p.m.—Conversazione at The Walker Art Gallery.

FRIDAY, JULY 17.

10 a.m.—Meeting of sections.
3 p.m.—Garden party by The Right Hon. the Lord Mayor of Liverpool, M.P.

SATURDAY, JULY 18.

Excursions—Inspection of docks and various places of interest:

1. Chester, the Dee, and Eaton Hall.
2. Chester and Hawarden.
3. Llandudno and neighbourhood.
4. Isle of Man and other places of interest.
5. Rivington Watershed.

NOTE.—Some of these excursions may be arranged for days other than Saturday.

SUNDAY, JULY 19.

11 a.m.—Special service at the Cathedral. Sermon by the Right Rev. the Lord Bishop of Liverpool, D.D.
(Delegates and members are requested to wear municipal or academic robes.)
Special services at other places of worship.

MONDAY, JULY 20.

10 a.m.—Meeting of sections.
7 p.m.—Dinner of the Congress. Tickets 10s. 6d. each. Ladies invited.

TUESDAY, JULY 21.

10 a.m.—Annual Meeting of the Fellows and Members of The Royal Institute of Public Health.
Meeting of sections.

The various railway companies will grant (1) return tickets to Liverpool from any station, available from July 14 to July 22, at fare and a quarter; (2) daily tickets will be available on the Midland and Great Northern Railways; (3) periodical tickets will also be issued by the Midland Railway.

In the case of No. 1 a certificate has to be produced, which can be obtained from the Honorary Secretary, Municipal Offices, Liverpool. In Nos. 2 and 3 cards of membership must be produced at the booking office.

Particulars concerning hotel and lodging accommodation can be obtained on application to the Honorary Secretary of the Congress, Municipal Offices, Liverpool.

THE ROYAL INSTITUTE OF PUBLIC HEALTH.

The following have been elected Members of The Royal Institute:

As Fellows:

Major SAMUEL BUTTERWORTH, R.A.M.C.

Major GEORGE WILLIAM JENNEY, I.M.S.

JAMES JOHNSON, ESQ., L.R.C.S., L.F.P.S. Glasgow, Medical Officer of Health, Bispham.

Major HUGH BRODRICK MATHIAS, R.A.M.C., D.S.O.

JOSEPH BRISCOE STEPHENSON, Esq., M.D. Durham, D.P.H. Dublin, Johannesburg, S. Africa.

As Member:

FREDERICK EDWARD HILLEARY, Esq., LL.D., Town Clerk, West Ham.

As Associate:

SAMUEL LAMBERT, Esq., Manager, Metropolitan Asylums Board, 125, Barnsbury Road, London, N.

THE CITY OF EXETER.

THE Medical Officer of Health for Exeter has issued his report for 1902 of the Vital Statistics and Sanitary Work of the City of Exeter. The birth-rate is 21·3 per mille, which is 7·3 below that of England and Wales; but the death-rate as corrected is 16·5 per mille, or ·2 more than the death-rate for England and Wales. The report gives careful analyses of the mortality from the various diseases notifiable and non-notifiable, as well as a clear account of the thorough measures which have been taken by Dr. Woodman and his assistants to cope with a threatened outbreak of small-pox and an actual epidemic of scarlet fever. The inspection of factories and workshops has been taken up, and in the current year there is no doubt that this very important part of the duties of the sanitary administration will receive the most careful attention.

PUBLIC HEALTH MEDICAL APPOINTMENTS.

THE following Public Health appointments are announced:

BARCLAY, WILLIAM BOWIE, Esq., L.R.C.P. Edin., Medical Officer at Aldershot.

BIDDLE, HENRY GEORGE, Esq., M.R.C.S., Medical Officer of Health, Broadstairs.

BLAIR, ALEXANDER, Esq., M.B. Glasg., Medical Officer of Health, Ashington Urban District Council.

GRAY, WALTER GORDON, Esq., L.R.C.P. Edin., Medical Officer of Health, Holsworthy (Devon) Urban District Council.

GRIMWADE, ALFRED SHEPPARD, Esq., M.R.C.S., Health Officer, Caulfield, Victoria, Australia.

WILLIS, CHARLES, Esq., M.B. Sydney, Health Officer, Lemonville, West Australia.

DIPLOMAS IN PUBLIC HEALTH.

THE following diplomas in Public Health have been conferred:

University of Durham—Reginald Bigg, M.B. Durh.; Joseph James Trench, M.B. Durh.; James McConnell, M.B. Durh.; Laurence McNabb, M.B. Durh.; Sydney Garratt Vinter, M.R.C.S. Eng.

Royal Colleges of Physicians and Surgeons in Ireland Conjoint Examination.—*A*, with honours: Lieutenant-Colonel George Frederick Alexander Smythe, F.R.C.S. Edin., R.A.M.C.; Captain James Dorgon, M.B., R.A.M.C.—*B*, pass: George Hamill, F.R.C.S. Irel.; Martyn Cecil Beatty, L.R.C.P., R.A.M.C.; Richard Arthur Campbell, L.R.C.P.; Francis Glancy O'Donohoe, L.R.C.P.; John O'Hare, M.B.; Walter Courtenay Rivers, M.R.C.S., R.A.M.C.; Colonel Ronald Huntly Nicholson, L.R.C.P. Edin., R.A.M.C.

BOOKS, JOURNALS, REPORTS, ETC., RECEIVED.

THE following books, papers, journals, etc., have been received:

A Manual of Plague. Major W. E. Jennings, I.M.S., F.R.I.P.H. *Rebman, Limited.*

The Lancet; The British Medical Journal; The Sanitary Record; The Surveyor; The Medical Times and Hospital Gazette; The Medical Review; The Pharmaceutical Journal; The Councillor and Guardian; Albany Medical Annals; The Glasgow Medical Journal; Public Health; The Journal of Applied Microscopy; The Journal of the Society of Chemical Industry; Egésyég; La Presse Medicale; La Salute Pubblica; The Journal of Tropical Medicine; The Caledonian Medical Journal; The Public Health Engineer; The Journal of the Sanitary Institute; Journal United Service Institution.

The Relation of the Panama Canal to the Introduction of Yellow Fever into Asia; Treatment of Phthisis by Urea, J. L. Baskin.

Annual Reports: Borough and Port of Lowestoft; Merthyr Tydfil, U.D.C.; City of Coventry; Borough of Eccles: Sanitary and Market Departments; City of Edinburgh.

REVIEW.

A Manual of Plague, by Major W. E. JENNINGS, I.M.S. Rebman, Limited. 8s. net.

The author has had a singularly wide and valuable experience of plague, and deals with the subject as one having great authority. He realizes, and in his interesting work vividly depicts, the administrative difficulties which plague officers have encountered. It is a valuable and pleasant addition to our knowledge of the subject, and the illustrations are of considerable interest.

WE have received from Messrs. Corbyn, Stacey and Co. samples of their new disinfectant, Antiseptoform. It is a paste which when ignited gives off the characteristic odour of formaldehyde gas. It is fatal to bacteria and pathogenic organisms, and possesses the valuable merits of simplicity, cheapness, and efficiency. No cumbrous or elaborate apparatus is necessary, and this invention should therefore be welcomed by Sanitary Authorities with narrow means. Our experiments with it have not included any test for its efficiency under variations of temperature and air moisture such as are to be met with in the tropics, but doubtless the manufacturers have given this point every consideration.

Letters, Notes, Queries, etc.

Communications respecting Editorial matters should be addressed to "THE EDITOR, JOURNAL OF STATE MEDICINE, 19, Bloomsbury Square, W.C." *Those concerning business matters, non-delivery of the* JOURNAL, *etc., should be addressed to* "THE SECRETARY, The Royal Institute of Public Health, 19, Bloomsbury Square, W.C."

The agents for advertisements appearing in THE JOURNAL OF STATE MEDICINE are Messrs. Van Alexander and Co., 5, York Buildings, Adelphi, W.C., Telephone No. 1404, Holborn, to whom all communications with reference to advertisements should be addressed.

Communications which have been sent to other journals cannot be received.

Correspondents who wish notice to be taken of their communications should authenticate them with their names—of course not necessarily for publication.

Telephone number of The Royal Institute of Public Health, No. 1614 Central.

The Journal of State Medicine.

THE OFFICIAL ORGAN OF
THE ROYAL INSTITUTE OF PUBLIC HEALTH.

VOL. XI.] JULY, 1903. [No. 7.

ON SOME DIFFICULTIES IN THE DIAGNOSIS OF SCARLET FEVER.

BY

ALLAN WARNER, M.D., D.P.H.,
Assistant Medical Officer of Health, and Resident Medical Officer of the Isolation Hospital, Leicester.

THE diagnosis of unusually mild attacks, or aberrant forms, of scarlet fever is generally admitted to be one of extreme difficulty, and I am inclined to think that during the last two years this difficulty has been increased by Dr. Clement Dukes' description* of what he has provisionally called the "fourth disease." This disease, he admits, at times so closely resembles rubella as to lead "to the confusion of two diseases under this title," and at others so nearly simulates scarlet fever that "the two diseases have been described under this one name."

Dr. Clement Dukes,† in writing of the "fourth disease," says "I must press the fact home that many of these cases find their way to fever hospitals, though sometimes they are not admitted on account of not being scarlet fever. . . . At other times they are received into scarlet-fever wards of hospitals, and there become attacked by scarlet fever, and give the 'fourth disease' to the scarlet-fever patients already in the ward (I conclude that it has been under such circumstances that what have been termed 'second attacks,' or relapses, have been diagnosed)."

Since reading the above paragraph, I have treated in the scarlet-

* *Lancet*, July 14, 1901. † *Brit. Med. Journ.*, October 24, 1901.

fever wards of the Leicester Isolation Hospital about 600 patients, and have kept a careful record of all rashes that have developed among these cases subsequent to their admission to the hospital, with a view to determining if the alleged "fourth disease" ever made its appearance in these wards.

I find now, on referring to my notes, that there has been a case of morbilli on two separate occasions, each of which was isolated as soon as observed, and apparently gave rise to no other cases. But beyond these two, twelve patients have developed a rash resembling scarlet fever, and it is these cases that I purpose recording in the present paper.

GROUP I.—TWO CASES OF TRUE SCARLATINAL RELAPSE.

CASE I.—A girl, aged four years, commenced to be ill on December 27, with sore throat and vomiting; rash appeared on the 29th. She was admitted to the hospital on January 1 with a fading scarlatiniform eruption, inflamed tonsils, peeling tongue. Temperature 99·8°. This attack was followed by desquamation on hands and feet, otorrhœa, and adenitis.

On February 4 (thirty-five days after admission) a second attack began with sore throat and vomiting; the next day a well-marked punctate erythema appeared. Temperature 102°; pulse 130. She was discharged on March 31, having desquamated a second time on hands and feet. This patient's sister was also admitted to the hospital on January 1, apparently suffering from genuine scarlet fever. She desquamated freely, and did not develop a second attack.

CASE II.—A girl, aged nine years, was admitted to the hospital on July 10, 1902. She complained of sore throat and was sick on the 8th, and a rash appeared the following day. On admission, her fauces were injected, she had the "strawberry" tongue, and scarlatiniform eruption. Temperature 102·2°; pulse 130. This attack was followed by desquamation on hands and feet; there were no complications. On August 7 a second attack commenced (*i.e.*, twenty-eight days after original onset), with inflamed fauces and vomiting. The following day there

was a well-marked scarlatiniform eruption, the tongue was furred, the fauces injected, with a slight deposit on the tonsils (no diphtheria bacilli present). Pulse 144; temperature 101°. On the 12th the tonsils were clear of deposit; there was slight desquamation on the ears and neck. Subsequently the hands and feet desquamated for the second time.

The symptoms of the "fourth disease," as described by Dr. Dukes, are so extremely varied, and its resemblance to some attacks of scarlet fever is so close, that to distinguish the one from the other at times seems to me impossible. However, in these particular cases both the primary and secondary attacks had some definite symptoms which were opposed to either having been the "fourth disease."

We are told of this disease that there is no vomiting at onset, that the tongue does not peel, that with the fullest rash the pulse is generally not increased in frequency, that the temperature is usually not raised above 99°., that the fullest rash is not necessarily followed by desquamation, and that of sequelæ there are practically none.

Therefore that the first attack in Case I. was the "fourth disease" is negatived by vomiting at onset, peeling tongue, otorrhœa, and adenitis; likewise the second attack by vomiting at onset and a pulse-rate of 130 per minute; whilst in Case II. the first attack was accompanied by a "strawberry" tongue and a pulse-rate of 130 per minute, the second attack by vomiting, pulse-rate 144, and peeling tongue.

Such cases as these, where both the first and second attack is characteristic of scarlet fever, appear to me to put the possibility of scarlatinal relapse beyond dispute.

However, Dr. Dukes seems to doubt that such relapses ever occur, and lays considerable stress on this point in his original communication on the subject of the "fourth disease." He says: "The fundamental law of medicine affirms that one attack of an eruptive fever entails immunity from a second attack in the same individual during childhood." If, then, we accept this very comprehensive fundamental law of medicine, we must not, I think, interpret it too rigidly; for we all admit that the pro-

clivity to an infectious disease may be largely removed by recovery from it, but in some cases the immunity thus conferred is only of short duration, as in diphtheria, erysipelas, and influenza. Again, a relapse in enteric fever is in reality a fresh attack of the disease, in which we find the whole train of symptoms of the first attack repeated. It appears to me, then, that a scarlatinal relapse is to some extent comparable with a relapse of enteric fever, the existence of which, I presume, none of us will doubt.

Group II.—Two Cases of Doubtful Scarlatinal Relapse.

Case III.—A girl, aged three years, commenced to be ill on January 14, with sore throat; an eruption appeared on January 18. She was admitted to the hospital as a case of scarlet fever on January 22; her fauces were inflamed, no rash was visible, and her temperature was subnormal; subsequently there was slight desquamation on her body and feet.

On February 17 (twenty-six days after admission) her temperature rose to 102·2°, and was accompanied by vomiting, inflamed fauces, and a scarlatiniform eruption. This attack was followed by profuse desquamation and severe cellulitis of the neck.

Case IV.—A girl, aged seventeen years, commenced to be ill on May 23, and noticed a rash upon her face, which quickly became universal. She was admitted to the hospital on May 24, with inflamed fauces, furred tongue, a universal erythematous eruption (not punctate), temperature 108·8°. Four days later the rash had disappeared and the temperature was normal; subsequently there was distinct desquamation on the face.

On May 30 (*i.e.*, six days after admission) her temperature rose to 103·4°, and this was followed by a typical attack of scarlet fever.

The medical men who notified these cases—both men of wide experience—assure me that, in their opinion, there is no doubt that the primary attack in each case was scarlet fever. If such is a fact, these must be considered as two further examples of scarlatinal relapse, but personally I do not feel that the first

attacks were sufficiently characteristic of the disease to warrant my classifying them as such.

GROUP III.—FIVE CASES OCCURRING IN TWO FAMILIES, IN WHICH THE PRIMARY ATTACK WAS PROBABLY AN INFECTIOUS DISEASE OTHER THAN SCARLET FEVER.

Family I.

CASE V.—Florence R., aged nine years, onset of illness November 14, no vomiting; rash November 17; admitted to hospital as scarlet fever, November 22, with fading rash, swollen tonsils, tongue normal, temperature 100°. Second attack commenced on November 28 (six day after admission), with temperature 102°, follicular tonsillitis, followed the next day by vomiting, furred tongue, and scarlatiniform eruption; subsequently the tongue peeled; there was profuse desquamation and acute rheumatism.

CASE VI.—Gertrude R. (sister of above), aged eight years, onset of illness November 16, no vomiting; rash November 19; admitted to hospital as scarlet fever November 22 (with the previous case), with swollen tonsils, fading rash, temperature 100°. Two days after admission temperature became normal, and patient appeared convalescent; on December 4 (twelve days after admission) follicular tonsillitis, temperature 100°; again convalescent on December 9; on December 18 (twenty-six days after admission) temperature 101°, tonsils inflamed, vomiting, followed the next day by scarlatiniform eruption; subsequently free desquamation and adenitis. There was no desquamation after first attack.

CASE VII.—Horace R. (brother of previous two cases), aged three years; onset of illness November 27, with sore throat, vomiting, and slight coryza; rash November 28; admitted to hospital as scarlet fever November 28, with slight coryza, no rash visible, tongue normal, temperature normal (as the symptoms were entirely negative, this patient was kept with his brother in a separate ward). Second attack commenced on December 8 (ten days after admission), with vomiting, inflamed fauces, temperature

99°. The next day a marked scarlatiniform eruption appeared, followed by peeling tongue, rhinorrhœa, otorrhœa, adenitis, and free desquamation.

Thomas R. (another brother), aged one and a half years, onset, coryza and rash, on November 25; admitted to the hospital as scarlet fever November 28, with slightly inflamed fauces, coryza, no rash, tongue and temperature normal; discharged after thirty-seven days in the separation ward, having shown no signs of scarlet fever.

Family II

CASE VIII.—Isabella W., aged six years, illness commenced on May 10, with sore throat; eruption appeared May 12. Admitted as scarlet fever, May 14, with fading rash and swollen tonsils, followed by slight desquamation on back. Patient was to have returned home on June 17 (after thirty-four days in hospital), when a bright erythema appeared on trunk and thighs, tongue furred, tonsils inflamed, temperature 99°, followed by free desquamation.

CASE IX.—Estella W. (sister of above), aged four years, commenced to be ill on May 16, with sore throat and rash; admitted as scarlet fever May 17, with scarlatiniform rash, furred tongue, swollen tonsils, temperature 99°, followed by slight desquamation on back; no complications. Discharged after thirty-two days in hospital. Two days after returning home she developed a severe attack of scarlet fever, and infected two others in the house.

Marjorie W. (sister of above), aged three years, commenced to be ill on May 18, with rash, no vomiting, no sore throat; admitted as scarlet fever on May 19 (two days after her sister), with well-marked scarlatiniform eruption, furred tongue, swollen tonsils, temperature 99°, followed by sore nose, slight adenitis; no desquamation. Discharged after thirty days in hospital, and did not develop scarlet fever at home.

To refute the diagnosis of scarlet fever after five or six days' illness is sometimes extremely difficult, the symptoms in many cases at this period being entirely negative. On several occasions

I have isolated such cases, and in due time have found that these patients have desquamated freely, and have had other sequelæ of scarlet fever. On the other hand, some patients on admission to the hospital have one characteristic symptom, with no others to confirm the diagnosis. Now, isolation wards are not always available for such cases; consequently some doubtful ones have to be put in the general wards. It is under this category of doubtful cases that I should include the above seven. It is noticeable that the premonitory symptoms of the first attack in Family I. were unlike scarlet fever, and it cannot be said that the subsequent symptoms of the first attack in Family II. were characteristic of it. Granting, then, for the sake of argument, that the original diagnosis of these seven cases was erroneous, what was the primary disease? Presumably it was an infectious disease—as four children in one family and three in another were affected alike in quick succession—a disease marked by slight pyrexia, fugitive rash resembling scarlet fever, coryza in two cases, not followed by desquamation on hands or feet or other sequelæ. It is noteworthy, however, that although the sufferers were in contact with a number of scarlet-fever patients for some weeks, they apparently did not infect any of them.

If the assumption be correct that the primary disease was an infectious one, the diagnosis seems to me to rest between rubella and the alleged "fourth disease."

It may be well, therefore, to consider what are the distinguishing features of these two diseases.

1. *The Eruption.*—Under this heading Dr. Dukes says* of rubella that the majority of cases commence and terminate in the main like measles. But there is another set of cases where the eruption, while commencing like measles, finishes in patches resembling scarlet fever, owing to the coalescing of the spots. It is not, however, such cases to which the name of the "fourth disease" is applied.

Dr. Dawson Williams,† writing of rubella, after describing the early eruption, says: "The rash in any particular area may

* *Brit. Med. Journ.*, November 2, 1901.

† Clifford Allbutt's "System of Medicine," vol. ii.

begin to fade in a few hours, and fading is seldom delayed beyond twelve hours ; but before this occurs the eruption may undergo a marked change, owing to the spread of bright-red flush on the face and neck, while at the same time the limbs become covered by a fine punctate rash, indistinguishable from that of scarlet fever." Whilst Dr. Dukes* describes the "fourth disease" "as covering the whole body with a considerable diffuse rash in a very few hours. The hue is bright rosy red, and the eruption is raised somewhat from the surface of the skin." So that the difference between the two eruptions in certain cases amounts to this: that the "fourth disease" resembles scarlet fever from the onset, whilst rubella may give rise to a similar eruption, preceded for a few hours by minute rosy red dots starting on the face and ears.

It is obvious, therefore, that the opportunity for observing the eruption at the right moment is essential for the differentiation of these two diseases on this symptom alone.

2. *Desquamation.*—The "fourth disease" may give rise to as copious a desquamation as scarlet fever or as slight as rubella.

3. *Protection.*—Rubella affords no protection against scarlet fever or the "fourth disease." The "fourth disease" affords no protection against scarlet fever or rubella.

4. *Infectiveness.*—Rubella, ten to fourteen days. "Fourth disease," ten to twenty-one days.

Dr. Dukes† drew up a table of twenty distinguishing characteristics between rubella and the "fourth disease," but the above four are the only ones that appear to me to differ at all, none of which give any assistance in diagnosing the disease in the cases under consideration.

Group IV.—Three Cases in which there is no Evidence that the Primary Attack was due to an Infectious Disease.

Case X.—John H., aged twenty years, onset of illness March 10, with sore throat; eruption on chest appeared March 13. Admitted

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* *Lancet*, July 14, 1901. † *Ibid.*

as scarlet fever on March 14, with swollen tonsils (chiefly the right); slight erythema on chest; temperature 99·6°. Two days after admission temperature became normal; there was no desquamation, and he appeared convalescent until April 8 (twenty-five days after admission), when temperature rose to 101°, and the fauces were inflamed. The next day, temperature 103°, vomiting, well-marked scarlatiniform eruption, followed by deposit on right tonsil; no diphtheria bacilli present; subsequently he desquamated freely on hands and feet.

Case XI.—Henry D., aged nineteen years, onset of illness April 11, with sore throat and rash on chest; admitted as scarlet fever on April 12, left tonsil inflamed, bright erythema on chest, no punctation, temperature 100°. The temperature remained slightly above normal for the next three days; no desquamation followed; subsequently the patient appeared perfectly well until May 1 (nineteen days after admission), when temperature rose to 100°, and fauces were inflamed. The next day a scarlatiniform eruption appeared, starting on chest and extending over limbs; temperature 103°; subsequently he desquamated freely on hands and feet. These two young men were mutual friends, living in the same street, and their primary attacks were remarkably alike, commencing with pyrexia and inflamed tonsils, followed by eruption, which on admission to hospital—second day of eruption—consisted of a simple erythema confined to the chest and neck, not followed by peeling tongue or desquamation. Under the circumstances I believe one is justified in diagnosing the first attack, in each of these cases, as a simple tonsillitis accompanied by erythema, a condition described by Caiger,* whilst the second attack in both cases was undoubtedly scarlet fever.

Case XII.—Lottie W., aged three years, admitted as scarlet fever on June 24, desquamating freely, "branny" on back and limbs, shreds peeling off palms and soles; temperature 100°. The next day the temperature was normal, and patient appeared convalescent. On July 9 (fifteen days after admission) temperature 101·2°, vomiting, tongue furred, fauces inflamed. Next day

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* Clifford Allbutt's "System of Medicine," vol. ii.

scarlatiniform eruption appeared, temperature 103°, pulse 144, followed by deposit on both tonsils; no diphtheria bacilli present; peeling tongue, rhinorrhœa, otorrhœa, and free desquamation. This patient's sister was also admitted as suffering from scarlet fever; her back and limbs were covered with rather a coarser type of scales than is usually seen in this disease, but the palms and soles were peeling very much like that of scarlet fever. A history was subsequently obtained of both patients having recently been treated for severe attacks of eczema by another medical man, and they were apparently notified as suffering from scarlet fever from the symptom of desquamation alone.

To my mind, far too much weight is attached to the question of desquamation in this disease, for I believe no form of desquamation is characteristic of it; an indistinguishable condition often follows other diseases, such as typhoid and diphtheria—indeed, at times it is simply a sequel to prolonged confinement in bed, whilst at others frequent immersion of the skin in water will give rise to what has been called characteristic pinhole desquamation and peeling shreds from palms and soles. Under these circumstances, I think that desquamation alone should never be the basis for notifying a case of scarlet fever, unless there be strong confirmatory evidence, and even then it would be well to notify it as a "doubtful case."

On the other hand, I am convinced that many mild cases of scarlet fever are not followed by any so-called "characteristic desquamation," and it is, therefore, quite erroneous to negative a doubtful case on the ground that this process has not followed the early symptoms.

In conclusion, let me briefly summarize the deductions made from the twelve cases which developed a secondary eruption whilst in hospital:

1. In all cases the second attack was true scarlet fever.

2. In two cases the second attack was a true scarlatinal relapse, and in two others doubtful relapse.

3. In the remaining eight the primary attack was not scarlet fever, one being eczema, two tonsillitis, five either rubella or the alleged "fourth disease," if such really exists.

With regard to the alleged existence of a "fourth disease," it appears to me quite possible that such is the case, but the evidence of it is not yet conclusive, nor do I think any description of it has yet been given which will enable the ordinary practitioner to diagnose it.

During the last few years the value of isolation hospitals has been frequently questioned. Of all the allegations made against them, I think that one certainly worthy of consideration is that, through erroneous diagnosis, persons not suffering from scarlet fever are sent into hospital, and there contract the disease.

Undoubtedly a large number of such grave accidents as the above mentioned have been prevented by our practice of examining all cases carefully before admitting them to the general wards. But it is quite impossible to negative the diagnosis of scarlet fever at times, and equally impossible for the general practitioner, at times, to make the diagnosis, although he may have strong suspicion that the case is one of scarlet fever.

I would therefore suggest that scarlet fever should be notified only in cases where the symptoms are definite, and that all suspicious cases should be notified as cases of doubtful scarlet fever, which then could be isolated at home. Consequently, I am fully in accord with Dr. Newsholme* when he states that the time is ripe for asking the Legislature for notification of suspected as well as fully recognised cases of scarlet fever and diphtheria.

* Annual Report, 1902.

NOTICE TO FELLOWS AND MEMBERS.

THOSE Fellows and Members desirous of attending the Congress of The Royal Institute of Public Health in Liverpool are requested to communicate their intention at once to Dr. Hope, Municipal Offices, Liverpool.

REFUSE DISPOSAL IN CAMP.

BY

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THERE is little doubt, according to the experience of those acquainted with the general conditions of active service, that a large proportion of the diseases to which the soldier is peculiarly liable while engaged in the field result directly from the faulty disposal of the organic material which must of necessity collect about the habitations of man.

In virtue of certain vital agencies existing in the upper layers of the soil, Nature makes provision for the reduction of organic to inorganic material, the latter serving as food for vegetable forms of life, which, being in turn consumed by the animal creation and subsequently voided in the various excreta, complete the cycle of change on which the existence of all life depends. It follows from the above facts, which, of course, are sufficiently well known, that the natural destination for organic refuse is the earth, where harmful and offensive material is turned to purposes of essential utility in the scheme of Nature. Unfortunately, the agencies upon which the above process depends are limited in their powers, so that if space as regards soil is limited, or organic material excessive, there results a partially reduced mass of highly offensive matter, which forms an excellent breeding-ground for microbial life, certain harmless forms of which may, there is reason to believe, assume under these circumstances pathogenic powers of a sufficiently pronounced character. The practical application of these facts to the conditions of active service is fairly obvious. It is well known that in every camp the soil tends sooner or later to become polluted with all kinds of filth, and that in consequence certain diseases, notably enteric fever and dysentery, almost invariably make their appearance; and the above sequence of events has been repeated too often, according to all experience, to leave any reasonable doubt as to the relationship in this connection of cause and effect. Latrine trenches and rubbish

pits are often dug to a depth which must place their contents beyond the reach of those reducing agencies to which allusion has been made, and even if this is not the case, the concentrated nature of the refuse is a bar to its ready transformation into those simple chemical compounds which result when the process of reduction is carried out to its final completion. On the other hand, there is every reason to believe that liquefaction of the fæcal or other organic matter takes place, with subsequent percolation through the soil and consequent danger of the most serious kind to neighbouring water-supplies. As latrine trenches are multiplied, so the danger increases, and there is no doubt that standing camps are in many cases absolutely honeycombed with what may, for all practical purposes, be considered as nothing more or less than leaking cesspools.

It is a necessary consequence of the above that the question of refuse disposal is one of the main points which should occupy the attention of the sanitary officer in the field. It is, of course, at all times easier to indicate a fault than to suggest an appropriate remedy, and there is no possibility of laying down rules which can meet all the varying conditions of active service. There are, however, certain measures suggested by experience which seem to embrace a fairly wide field of applicability.

An example of such measures and of their results may not be out of place.

During the latter part of the South African Campaign, a camp formed for the purpose of a depot for neighbouring columns, and also as a place of security where convoys could outspan for the night, was established at Tyger Kloof, on the Harrismith and Bethlehem blockhouse line.

For reasons which are outside the scope of this paper, the camp covered a comparatively restricted area, and forming, as already stated, a halting-place for convoys, the refuse which had in consequence to be dealt with called for sanitary proceedings of an exceptional nature. Kaffir labour was fortunately obtainable and not only was the filth produced by the mules and trek oxen regularly carted away, but all other refuse as well. Bucket latrines were substituted for trench latrines, and the excreta

removed regularly at suitable intervals. Practically no organic refuse remained in the vicinity of the camp, all such being conveyed away about half a mile over the veldt and then destroyed as far as possible by fire, incombustible material being buried. I may state that after considerable personal experience of camps in South Africa, there were none of them of which I have any knowledge which, as far as sanitation is concerned, could in any way compare with that in question; and while other posts along the blockhouse line, where refuse was buried without removal, suffered severely from enteric fever and dysentery, the camp in Tyger Kloof maintained, comparatively speaking, an excellent standard of health. Although this was the only camp with which I was acquainted where such a thorough removal as the above of organic refuse was carried out, and although to generalize from an insufficient number of facts constitutes a logical fallacy, it is not unfair to assume that the measures in question were in all probability causally related with the satisfactory condition of the health of the troops.

It is interesting to learn in this connection that the question of the removal of refuse from camps has occupied the serious attention of American Medical Officers. On p. 208 of the Annual Report for the year ending June, 1899, of Surgeon-General Stemberg, United States Army, to the Secretary of War, we read as follows: "During the movements of an active campaign, when a camp site is abandoned after an occupation of a few days, well-cared-for privy pits afford a simple and satisfactory means of disposing of the excreta of the command. When, however, the camp is one of some permanency, as is usual with camps of organization, recuperation, muster, or territorial occupation, the danger from the use of this primitive system of conservancy is proportioned, other things being equal, to the size of the command and the duration of its continuance on the same ground. With cases of typhoid fever, dysentery, or camp diarrhœa among the troops, the pits become foci of infection which make their influence felt throughout the whole of the camp. . . . To preserve the health of the men in these camps it is necessary to disinfect and remove the excreta."

Later on in the Report Surgeon-General Stemberg recommends the use for latrine purposes of "cylindric galvanized iron receptacles," which "should be removed at regular intervals and the contents emptied into a pit far from the camp, or disposed of by cremation." Colonel Greenleaf, Medical Inspector of the United States Army, in a Report dated San Francisco, California, July 31, 1899, speaks most favourably of the removal from camp of all excreta either in boxes or odourless excavating carts. "Kitchen garbage and camp refuse," he states, "are cremated or carted to distant points." In short, the principle of removal strongly favoured in the Report is, although differing in details, fundamentally identical with that which was followed with the most satisfactory results in the camp which I have mentioned.

In other camps of which I have had experience in the recent campaign removal of refuse was, owing generally to absence of the necessary labour, a matter of impossibility, with the result that enteric fever and dysentery sooner or later made their appearance. It is perfectly true that Tyger Kloof was not free from these diseases, but it was singularly free in comparison to other localities in the same neighbourhood, and this in spite of the fact that the camp was restricted in area, and the conditions tending to soil pollution were excessive.

Whether the colon or other bacilli can undergo transformation in the *Bacillus typhosus* is a matter concerning which, from my own knowledge, I am not in a position to make any assertion.

Two points, however, are worthy of attention: Firstly, that according to the observations of Roux the colon bacillus when grown in sewage is capable of imparting a disease clinically indistinguishable from enteric fever; and, secondly, that the portion of latrine contents which percolates into the soil becomes converted into basic nitrates, and being, as a rule, too far from the surface to be taken up as food by plants, it forms an excellent medium for the growth of any typhoid bacilli which may be present. It follows from the above that a latrine trench is an unsuitable destination as regards the disposal of enteric excreta, at any rate until the latter are rendered innocuous by sterilization. According to recent researches by Firth and Horrochs, the

enteric bacillus can survive for seventy-four days in moist soil (*British Medical Journal*, September 27, 1902). This fact strongly indicates the danger of burying enteric stools until they have been sterilized. Boiling according to the means designed by Major Cummins, R.A.M.C., would answer well for this purpose. Burning typhoid excreta, or, indeed, other forms of refuse containing large quantities of water, is not always satisfactory unless effected in a specially designed apparatus. If it is done in the open air an intolerable nuisance is created; the process is rarely carried out to its completion, and in consequence remnants of unconsumed filth are blown about the camp. Camp incinerators, of which there are several designs, appear from written descriptions to yield excellent results; but such appliances are not always available, and in these cases an improvised refuse destructor, which I designed at Aldershot, may be found fairly satisfactory. It consists of two trenches, about the depth and diameter of those of a camp kitchen, bisecting each other at right angles, with a chimney, constructed of sods, built over the angles of intersection. A fire is lighted at the foot of the chimney, and down the top of the latter the rubbish is thrown in small quantities at a time. The addition of a small amount of turpentine is a great help. A good draught is established, and, within reasonable limits, the higher the chimney, for this purpose, the better. It is true that I have not tried what the effect of this method would be in the field, but it is certainly a great improvement on burning refuse in the open, and might be resorted to when specially designed and elaborate methods are not feasible. The procedures which, in view of the above, seem to suggest themselves as likely to be efficient in connection with the safe and satisfactory disposal of refuse are as follows:

In the case of a camp which is in temporary occupation only, shallow latrines within a foot or less of the surface will meet all the requirements of the case. The excreta in the trenches will be brought under the immediate influence of those reducing organisms which are found close beneath the surface of the soil, and after transformation into simple chemical compounds will be utilized as food by any vegetation which may be present.

Shallow earth burial may also be resorted to as regards kitchen refuse.

In camps of more permanent occupation the above method can scarcely be suitable, unless a practically unlimited area of land is available. As a rule, removal, and removal only, wherever it is possible, will be the only method likely to prove satisfactory. The ordinary latrine bucket will be found to answer all purposes as regards excreta. Water or carbolic lotion may well be substituted for dry earth. Soldiers are proverbially careless as regards sanitation, many of them neglecting entirely to use the earth provided in the latrines. With the use of liquid in the buckets this difficulty disappears. A certain amount of dust also results from the use of dry earth, and flies are constantly to be found crawling over the contents of the buckets, even when earth has been carefully used.

On the whole, the other method suggested—*i.e.*, the use of liquid—would appear to give the best results. Removal should be followed by burial, except in the case of enteric excreta, which requires special treatment. Other refuse, besides excreta, should be removed and burned, or buried after removal if burning is not possible.

In the Afghan War carcasses of dead transport animals were soaked with kerosene and burned. This method was well spoken of, but I have no experience of it myself.

The danger to health accruing from the presence of decomposing organic matter need not be insisted on here; its removal from the immediate precincts of any form of habitation is evidently a matter of prime necessity, and the sanitary history of the camp at Tyger Kloof affords a useful object-lesson of the results which flow from a rigid regard to what, after all, is one of the most elementary rules of common-sense, sanitation.

NOTE.—At Kilworth musketry camp, of which I was in charge in the late summer and early autumn of 1899, an exceptionally high standard of health prevailed, in spite of the fact that the ground had been in prolonged occupation. All refuse was, however, carefully removed.

PHTHISIS VIEWED IN RELATION TO DARTMOOR, TO DEVONSHIRE IN GENERAL, AND TO CONSTITUTION.

BY

WILLIAM H. PEARSE, M.D. Edin.

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Lord Bacon says: "Let us consider the false appearances which are imposed upon us by words, . . . and although we think that we govern our words, . . . yet certain it is that words, as a Tartar's bow, do shoot back upon the understanding of the wisest, and mightily entangle and pervert the judgment, so as it is almost necessary in all controversies and disputations to imitate the wisdom of the mathematicians in setting down, in the very beginning, the definitions of our words and terms."

If we examine deeply and closely, we shall find ourselves unable to define the word "phthisis."

Approached by the cellular pathology of Virchow of 1856, phthisis had essentially a cellular basis in tubercle, "always a pitiful production, a new formation, from its very onset miserable." Virchow was the apostle of continuity in pathology. He says: "I will . . . endeavour . . . to furnish you with proofs that every pathological structure has a physiological prototype, and that no form of morbid growth arises which cannot in its elements be traced back to some model which had previously maintained an independent existence in the economy."

Since Virchow's great announcement of biological and pathological cellular continuity, Koch has discovered the great place which bacilli hold in phthisis.

But neither the philosophy and facts of Virchow nor of Koch cover the field of phthisis, for we see that, in the main, only certain types of individuals pass into phthisis, and at certain definite ages only. These facts carry us out beyond and further back than can be expressed by either a cellular or a bacillary pathology; we are carried into the widest fields of orderly evolution and continuity. As expressed by the old Eastern

poet: "And in Thy Book all my members were written, which in continuance were fashioned, when as yet there was none of them."

This *a priori* philosophy of orderly evolution and continuity must ever govern our method, both in and beyond cellular and bacillary pathology.

The pollen in vain falls on the stigma, except at a certain period of receptivity; the bacillus in vain attacks lung bioplasm except at certain ages and in certain types of individuals, these individuals having had a far-back-reaching—individual or ancestral—series of disturbed biological correlations, both of structure and function.

My standpoint in viewing phthisis is neither cellular or bacillary, but is that of a varied stream of individuals who exhibit all the stages of prephthisis and phthisis. In the prephthisical cases I see the varied, long-preceding deviations of structure and function—a kaleidoscopic view in its variety, but always within a somewhat definite range of structure and function. I am cast back, as of old, into premicroscopic method—viz., that of observing Nature as presented, and, I hope, guided, by just philosophic analogy and method; for it cannot be denied that empiricism and observation are not dead as parts of true method.

From these remarks it will be clear that we cannot give a definition of phthisis; we can only approach its wide form or nature through its many channels or origins.

Dartmoor.—De la Beche describes Dartmoor as "an elevated mass of land, of an irregular form, broken into numerous minor hills, many crowned by groups of picturesque rocks, provincially termed 'tors,' and for the most part presenting a wild mixture of heath, bog, rocks, and rapid streams." It is of granite, and extends 22½ miles from north to south, and 18 miles from east to west. The highest point is Yes Tor, 2,028 feet, on the north of the region, the highest south elevation being Shell Top, 1,546 feet.

The whole region forms the central elevated part of a peninsula which runs out into the Atlantic Ocean. It receives the full flow of the Atlantic gales from south-west to north-west; it is a region

of wind, rain, mist, and, in the summer, of fresh breezes and hot sunshine.

Whilst the mean rainfall at Exeter for eight years was 33·82 inches, that at Princetown, 1,400 feet elevation, was 59·92 inches, at Rundle Stone 74·35 inches; both these places are in Central Dartmoor. Sheepstor, on the west, had a rainfall of 64·66 inches. For the tourist or the comparative invalid on Dartmoor, the whole region, except the actual tors, is gently undulating, moderately hilly, and easy of access. Dartmoor impresses the wanderer as being greater and wilder than its size and moderate elevation would lead one to expect. There is ceaseless variety in the scenery. Walking over Dartmoor, the physical body, the mind, and emotions or imagination, are all under a moderate, but yet powerful, stimulation. I feel sure that the mental and emotional stimulation, no less than the physical, which Dartmoor compels are powerful influences for good and for health in the prephthisical and in other states verging on disease.

Great fields of observation are open to the tourist—of meteorology, geology, botany, archæology, etc.

Our knowledge of the deeper activities of the atmosphere is but slight. This may be illustrated by a quotation from Professor Fleming's lecture at the Royal Institution, May 30, 1902, on the "Electronic Theory of Electricity": "Electrons were the basis of chemical action: they were always being produced in sunshine and bright light. It was a curious fact that the air at the foot of waterfalls was negatively electrified, whilst near sea-waves it was positive. This might account for the difference in benefit derived by different people from sea and mountain air." The immense influence of "change of air" on health is probably due to infinitely delicate differences in the "energies," "modes," and conditions of the atmosphere, to which the energies of the bioplasm reciprocate.

The influences of the activities of the summer climate of Dartmoor on those who, with varied functional failures, are verging into phthisis and other failures of health are very striking, and in their operation recall Goethe's words:

"Never was Nature, in her effluent powers
Of life, referred to days and hours;
She acts in calm and regulated course,
Knows nothing of this accidental force;
E'en in her works of most sublimity,
As in her least, no violence knows she!"

To illustrate the influence of Dartmoor on phthisis, West Dartmoor, which receives the full burst of Atlantic winds, rain, etc., gives as follows:

TABLE I.

Parish.	Mean Population of Parish.	Total Deaths of Phthisis in 10 years.		Death-rate.		Acres to Person.	Geology.	Death-rate.		Mean Death-rate, M. and F.	Average Acres to Person.
		M.	F.	M.	F.			M.	F.		
Meavy	271	1	1	0·73	0·75	12·1	Granite	—	—	—	—
Sheepstor ..	103	0	2	0	4·0	34·9	,,	—	—	—	..
Walkhampton ..	731	3	2	0·78	0·57	14·4	,,	—	—	—	-
Stampford Spiney	506	3	1	1·25	0·37	3·4	,,	—	—	—	—
Peter Tavy ..	417	3	0	1·44	0	8·3	,,	0·84	1·13	0·98	11·13

It should be remarked that the high death-rate of women in Sheepstor was due to one family, who were strangers to the district, and in which two sisters died of phthisis. Omitting this family, the female death-rate of the moorland granite district is 0·36. This great freedom from phthisis finds a parallel in a similar freedom of the North Devon coasts, where the death-rate was: M., 0·50; F., 0·21. This ratio is, as to M., 2·46, F., 2·48, for England and Wales, during the same years.

Both Western Dartmoor and North Devon get the full Atlantic winds and atmospheric activities. Our scientific knowledge of the potential and kinetic activities of the atmosphere is elementary, but we know empirically, and from the experience of mankind, that the incessant movement and intermovement must correlate with great energy — physical energy — in all its modes, and *à fortiori* with vital energy, in absolute continuity.

Here is the result, women's death-rate from phthisis in the two regions being respectively 0·36 and 0·21.

Another granite region is that of South Dartmoor, with a mean death-rate from consumption of 1·46—*i.e.*, M., 1·01; F., 1·92.

TABLE II.

Parish.	Mean Population of Parish.	Total Deaths of Phthisis in 10 years.		Death-rate.		Acres to Person.	Geology.	Death-rate.		Mean Death-rate, M. and F.	Average Acres to Person.
		M.	F.	M.	F.			M.	F.		
Harford	164	1	2	1·23	2·44	12·4	Granite	—	—	—	—
Cornwood ..	1,083	10	10	1·82	1·87	9·8	,,	—	—	—	—
Shaugh	592	0	4	0	1·49	14·7	,,	1·01	1·92	1·46	11·6

Shaugh, with a mean male population of 325, had no death from consumption in ten years. Ermington, with a mean female population of 972, had no death from consumption in ten years. Rainfall at Ridgway, 47·92 inches; Hemerdon, 49·26 inches; Ivybridge, 49·05 inches—these being neighbouring districts.

The Newton Abbot district has a varied geology. There are seaboard, Devonian, carboniferous, mixed new red sandstone with carboniferous, Bovey beds, and granite. The granite subregion, including Lustleigh, Moreton, North Bovey, Manaton, Widdecombe, Buckland, had a consumptive death-rate of 1·49, being the least of any of the areas of the Newton Abbot district, but the death-rate was higher than that of Western Dartmoor—*e.g.*, Widdecombe-in-the-Moor had 2·15 M., 0·72 F., against 0·84 M., 0·36 F., of the Tavistock granite area.

Sometimes a high death-rate affects the females of the region—*e.g.*, Manaton, on the granite, 3·14; Abbot's Kerswell, 3·7; Combeinteignhead, on the sandstone and Devonian, 3·11; Ipplepen, on the Devonian, 3·73; Trusham, on the carboniferous, 4·46.

The rainfall at Torquay is 37·69 inches; Bovey Tracey, 44·01; Widdecombe, 58·95; Ashburton, 51·38.

The granite region in relation to consumption is seen in Table III.

TABLE III.

Parish.	Mean Population of Parish.	Total Deaths of Phthisis in 10 years.		Death-rate.		Acres to Person.	Geology.	Mean Death-rate.		Mean Death-rate, M. and F.	Average Acres to Person.
		M.	F.	M.	F.			M.	F.		
Lustleigh ..	320	4	0	2·5	0	9	Granite	—	—	—	—
Moreton ..	1,509	12	9	1·62	1·16	5	,,	—	—	—	—
North Bovey ..	514	4	5	1·4	2·12	10	,,	—	—	—	—
Manaton ..	409	3	6	1·38	3·14	15	,,	—	—	—	—
Widdecombe ..	877	10	3	2·15	0·72	12	,,	—	—	—	—
Buckland ..	110	1	0	1·7	0	13	,,	1·79	1·19	1·49	10

The people of this fine region were, during the ten years, relatively free from phthisis, the M. and F. mean being 1·49.

Dartmoor also includes the following region on its south borders :

TABLE IV.

Parish.	Mean Population of Parish.	Total Deaths of Phthisis in 10 Years.		Death-rate.		Acres to Person.	Geology.	Mean Death-rate.		Mean Death-rate, M. and F.
		M.	F.	M.	F.			M.	F.	
Buckfastleigh ..	2,590	24	42	1·94	3·10	2·3	Granite(part)	—	—	—
Holne	338	1	2	0·57	1·22	11	,,	—	—	—
Dean Prior ..	410	4	4	1·99	1·91	10	,,	—	—	—
South Brent ..	1,326	10	17	1·51	2·56	7	,,	—	—	—
Ugborough ..	1,502	9	8	1·21	1·05	5	,,	1·44	1·96	1·70

The death-rate in Buckfastleigh is high amongst the women—3·10.

The seaboard of North Devon, on the Devonian formation, showed a remarkable freedom from phthisis. From the Foreland Cape, on the extreme east, to Baggy Point, on the extreme west of the north shore, are the parishes enumerated in the following table :

TABLE V.

Parish.	Mean Population of Parish.	Total Deaths of Phthisis in 10 Years. M.	Total Deaths of Phthisis in 10 Years. F.	Death-rate. M.	Death-rate. F.	Acres to Person.	Geology.	Mean Death-rate. M.	Mean Death-rate. F.	Mean Death-rate, M. and F.
Countisbury ...	192	0	0	0	0	18	Devonian and Sea	—	—	—
Brendon ...	271	0	0	0	0	24	,,	—	—	—
Lynton ...	1,106	1	0	0·19	0	6	,,	—	—	—
Martinhoe ...	214	0	0	0	0	11	,,	—	—	—
Paracombe ...	373	0	0	0	0	11	,,	—	—	—
Trentishoe ...	114	0	0	0	0	13	,,	—	—	—
Kentisbury ...	404	1	0	0·5	0	7	,,	—	—	—
Coombe-Martin	1,451	1	0	0·13	0	2·6	,,	—	—	—
East Down ...	412	0	0	0	0	8	,,	—	—	—
Berry Narbor	763	3	1	0·78	0·26	6·4	,,	—	—	—
Bittadon ...	60	1	0	3·8	0	10	,,	—	—	—
Morthoe ...	349	2	2	1·20	1·09	13	,,	—	—	—
Georgeham ...	794	0	6	0	1·47	5	,,	0·50	0·21	0·35

Thus the mean death-rate from phthisis for ten years in this bold seaboard region was 0·50 M., 0·21 F.; this splendid region west of Exmoor, bordering on the sea, and open to the west and north-west Atlantic winds, is almost free from consumption. Coombe-Martin, mean population 1,451, had one male only die in ten years.

Lynton, mean population 1,106, had one male only die of phthisis in ten years. During the same period no female died of phthisis in either parish.

The following parishes on the North Devon Devonian, with the mean population annexed, had no deaths from consumption during the ten years 1861-1870: Brendon, 271; Parracombe, 373; Bratton Fleming, 632: Stoke Rivers, 225; East Down, 412; Countisbury, 192; Martinhoe, 214; Trentishoe, 114.

The following North Devon parishes on the Devonian, with the mean population annexed, had each one death from consumption in the ten years 1861-1870: Challacombe, 282; Kentisbury, 404; Arlington, 229; Bittadon, 60; Lynton, 1,106; Coombe-Martin, 1,451; West Anstey, 300; East Anstey, 227; Twitchen, 238.

The town of Ilfracombe, judged as to some extent a resort of invalids, had a small mortality: M., 2·08; F., 1·75.

The rainfall was high in healthy districts: Bratton Fleming, 53·22 inches; Martinhoe, 60·82, having no deaths from phthisis in ten years. Ilfracombe rainfall, 37·51; Barnstaple, 39·47.

The South Molton district has thirty parishes, nine being on the Devonian, on the south-west borders of Exmoor. In these parishes the death-rate was: M., 0·56; F., 0·97; mean, 0·76.

There are also twenty-one parishes south of the above, and on the carboniferous system; their death-rate was: M., 0·88; F., 1·09; mean, 0·98; or slightly higher for the carboniferous system than for the more northerly Devonian. The death-rate is rather higher for women than for men.

The higher death-rate of the carboniferous system is seen also in the Holsworthy district, where it was: M., 1·77; F., 2·35. Holsworthy district is known as a clayey, damp, "cold" soil. Dr. Buchanan's researches showed "that a wetness of soil is a cause of consumption to those living on it." But it is the women who die in excess. Dr. L. Ash considered that the bad condition of the cottagers' huts predisposed to phthisis in the women.

The district of Axminster has nineteen parishes; the death-rate for men was 1·44, for women 2·16. The highest death-rates were in Axminster parish, 3·58, and Hawkchurch parish, 4·25—in both instances women. A similar high rate for women existed in Torrington, 3·08; also in Buckfastleigh, 3·10; Honiton, 2·35.

By the kindness of Dr. Power and Dr. Saunders I was supplied with the returns of mortality from phthisis for the Dartmoor convicts during the ten years 1866-1875, and for the lunatic asylum at Exminster during the ten years 1861-1870.

The mean death-rate of the prisons, 3·1, stands out in contrast with that of the asylum, 20·16.

The prisoners lived at an elevation of 1,400 feet, with a rainfall of from 59·92 to 74·35 inches, in the midst of high winds, fogs, and active atmospheric processes; their wards and workrooms are lofty; they spend much time also in out-of-door employment.

The lunatics at Exminster were no less cared for as to pure air and full cubic space, and in all other physical surroundings. The death-rate of the non-asylum people in Exminster parish

was 3·37; the near-by parish of Kenton, with a mean male population of 875, had during the same ten years a male death-rate of 0·57, with a mean female population during the same period of 1,034; there was no death from phthisis. Thus the locality of the asylum was healthy; its inner surroundings and management were good.

TABLE VI.

DEATHS FROM CONSUMPTION IN DARTMOOR PRISON DURING THE TEN YEARS 1866-1875, SUPPLIED BY DR. POWER.

Date.	Number of Prisoners.	Total Number of Deaths.	Deaths from Consumption.	Death-rate.
1866 ...	627	13	1	—
1867 ...	613	8	2	—
1868 ...	636	10	2	—
1869 ...	739	7	3	—
1870 ...	881	14	8	—
1871 ...	902	5	2	—
1872 ...	958	13	3	—
1873 ...	943	8	1	—
1874 ...	934	7	1	—
1875 ...	943	8	3	—
Totals ...	8,176	93	26	—
Means ...	817·6	9·3	2·6	3·1

TABLE VII.

PHTHISIS, EXMINSTER ASYLUM, 1861-1870.

	Total Parish.		Asylum.		Parish excluding Asylum.	
	M.	F.	M.	F.	M.	F.
Total mean population	865	986	270	398	595	588
Total deaths from phthisis	83	97	60	80	23	17
Percentage	9·59	9·83	22·22	20·10	3·86	2·89
Mean percentage ...	9·71		20·16		3·37	

The causes or biological conditions which led to the asylum mortality of 20·16 must be sought in those wide and infinite correlations of the system involved in the words—the "constitution of the insane."

Table VII. exhibits phthisis in Exminster and in its asylum. The asylum returns were furnished by Dr. Saunders.

I am in this paper viewing phthisis in a wide biological aspect. Herschel says: "There is something in the contemplation of general laws which . . . persuades us to commit ourselves unreservedly to their disposal; while the observation of the calm, energetic regularity of Nature, the immense scale of her operations, and the certainty with which her ends are attained, tends irresistibly to tranquillize and reassure the mind." We shall not, therefore, shrink from submitting our method, in harmony with the doctrine of orderly evolution and continuity; we use this method now as an *a priori* truth, and not least so in the regions of biology and pathology.

I have used the words "constitution of the insane" as holding the potential modes which sooner or later are apt to show as phthisis; though we associate insanity with the brain, yet it is a fatal error of method in biology to view the brain and mind as distinct and separated from other structures and functions of the system. The brain (epiblast)—mind and emotions—so disturbed in the insane, correlates with the body as a whole, with the sexual functions (mesoblast), the thyroid (hypoblast), etc.

It appears to me to be a matter of much interest to observe, record, tabulate, and correlate the variations of structure and function, both of those who are in the hovering stages of pre-phthisis, and of those who are in actual phthisis. A study of the biological deviations of structure and function of those of the insane who pass into phthisis would be important in biology and pathology.

The Exminster experience demonstrates a loss, too early in the life of the individual, of vital energy in the molecular bonds of lung-apex bioplasm in those who are insane.

This lung-apex bioplasm in the insane, at varying ages, yields to the stronger molecular attractions of the unicelled bacillus.

Biologically, the lungs are a late and extremely differentiated evolution. They "arise as two separate hollow buds, and are protrusions from the œsophagus" (Landois and Sterling). Like other remote parts of the body, they are apt to lose or to have expended their vital energy, early in the life of the individual.

I have for twenty-five years recorded every case of prephthisis and phthisis which has presented, where I could trace heredity, noting the correlations of structure and function. I have appended a table which exhibits these correlations, noting very slightly the chief directions in which deviation from normal types are shown, both in structure and function. It will be seen that we cannot assert that phthisis "is the work of a microbe—the tubercle bacillus discovered by Koch," nor confine our view to that final stage only; we must avoid being enchained by nosological definitions such as that "phthisis is a disease of the lungs"; a justly wide view of the form or nature of phthisis will hinder us from resting in the dogma that "phthisis is not an inherited vice." The great stream of prephthisical and phthisical cases which passes before me has shown that the final lung bacillary invasion is but a very minor part of the full form of phthisis. If we would rise to a just conception of phthisis we must use the method of evolution and continuity in general as applied to the organic kingdom; our definition of phthisis then would embrace the modes of the ovum and sperm cells, the blastoderm and its layers; and yet more, phthisis involves the differentiations of those layers as eventually passing both to function and structure. Why should the physician and pathologist be limited and confined to a verbal, nosological, or bacillary foundation or measure of disease, whilst the frend of all other organic and biological science is toward common forms, general alliances, and unity of law and order? Phthisis thus should be viewed from its primary roots and origins up through all its transitional stages, and in this method it will be found that heredity holds an ever-present influence.

I would ask observers to extend and develop in their profounder evolution the facts I have classed as correlations of phthisis under the bone system. The bone or skeletal systems are mainly

referable to the mesoblast. How is it that in a man not yet in phthisis, or in a man many of whose relations have died of phthisis, the hands are sometimes of prodigious size, or the terminal cartilages of the nose unduly large and pointed laterally? Such facts are thrust on me now and then as "glaring instances"; the conditions were differentiated, "yet unseen," in the mesoblast. We may express it in these terms—that the creative or evolutionary energy or motion has deviated from a just supply to the bioplasm of lung apices. But such skeletal mesoblastic deviations blend and correlate with those of the epiblast, the neuro-epidermal layer (Landois and Sterling); for it will be found commonly, that those with such skeletal deviations have deviations also of the nails, hair, and teeth—and not only so, but the whole mental and moral and emotional type, so fundamentally dependent on the "central nervous system," derived from the epiblast, is modified in the prephthisical and phthisical. Further, in the phthisical and prephthisical the generative organs are much influenced in women. Here the mesoblast is involved, and hardly less so, when we consider the refined type of the phthisical, the epiblast and nervous systems.

Further, in the phthisical and prephthisical the whole *primæ viæ*, or organic tract, is deeply involved—loss of appetite, inability to eat fats, costiveness, impaired digestive power, etc., showing involvement of the hypoblast; and in other directions, and which have profound corelations with the system and bioplasm in general, the passion for the allyl molecule, and other molecular modes of the onion.

The entire blastoderm, in its future differentiations, is involved; but what is very striking is that young people may run along for years, ever complaining of weakness, coldness, etc. In some such I have known phthisis to appear in a year, but in others many years may pass before lung-apex bioplasm relatively "dies," and bacilli assert then their stronger molecular attractions; others may live on and escape phthisis, so exquisitely delicate and involved are the essential conditions and correlations of lung-apex bioplasm.

It will be seen that the basis of phthisis extends back to former

TABLE VIII.—CORRELATIONS OF PHTHISIS AND PREPHTHISIS.

Group	Item	Phthisis: 42 men. 64 women.	Prephthisis: 43 Men. 161 Women.
	Father died of phthisis.	20	61
	Mothers died of phthisis.	36	45
	Brothers died of phthisis.	19	52
	Sisters died of phthisis.	32	74
	Grandfathers on father's side died of phthisis.	3	3
	Grandmothers on father's side died of phthisis.	7	1
	Grandfathers on mother's side died of phthisis.	4	6
	Grandmothers on mother's side died of phthisis.	3	4
	Uncle on father's side died of phthisis.	13	21
	Aunt on father's side died of phthisis.	13	20
	Uncle on mother's side died of phthisis.	3	14
	Aunt on mother's side died of phthisis.	14	46
	Cousins on father's side died of phthisis.	1	5
	Cousins on mother's side died of phthisis.	2	6
	Sons died of phthisis.	—	1
	Daughters died of phthisis.	19	3
Bone System.	Hands.	31	43
	Clavicles.	2	3
	Nose.	75	113
	Terminal cartilages of nose.	60	86
	Thorax and skeleton.	18	11
Skin System.	Nails.	67	99
	Hair.	16	21
	Eyebrows.	28	34
	Ears.	7	2
	Teeth.	25	33
	Con·enital absence of upper lat. incisors.	1	3
Sexual.	Amenorrhœa.	25	45
	Total amenorrhœa.	—	5
	Menorrhagia.	1	4
	Barren.	4	9
Varied.	Hæmoptisis.	—	8
	Malarial fever.	1	—
	Anæmic.	—	1
Digestive.	Indigestion.	12	46
	Costive.	1	3
	Anorexia.	20	16
	Smoked food much liked.	5	4
	Onions "	45	49
	Salted food "	16	25
	Pickles "	27	35
	Pork "	8	5
	Cheese "	5	9
Neuroses.	Weakness.	32	61
	Wasted.	9	9
	Sweats.	2	8
	Coldness.	31	41
	Heats.	9	—
	Diabetes.	1	6
	Eczema.	1	6
	Neuralgia.	17	11
	Phosphoric acid in urine.	1	—
	Goitre.	—	2

generations; also that structure and function correlate. Deviation of structure in one generation may have its analogue in disturbed function in another generation, and phthisis in a third generation. These fundamental deviations of the biological evolution, of those who tend to phthisis, may thus be atavic and alternate. We are reminded of Darwin's words: "We are led to believe, as formerly explained, that every character which occasionally reappears is present in a latent form in each generation." "In every living creature we may feel assured that a host of lost characters lie ready to be evolved under proper conditions."

The differentiations of every layer of the blastoderm are involved; their deviations or disturbances, as in prephthisis, often correlate and alternate during many generations.

The instance of like handwriting, transmitted through many generations and in the male line, will show us how profound and powerful are the molecular motions or modes of the sperm cell; not less delicate, yet all-powerful, are those modes of the ovum and sperm cells, which are eventually shown in the varied correlations of structure and function of the prephthisical, and which in many appear as a more or less, in different individuals, expended vitality of one lung apex.

Whilst Exminster Asylum reveals a part of the deep biological basis of phthisis, the influences of full physical energies in the surroundings of West Dartmoor and North Devon, reveal its modes of prevention—*i.e.*, the placing the living unit in the midst of those physical energies which make for and sustain vital processes. But as the organic evolution involved vast periods of time and energies of infinite power, yet delicate, so the influences and powers of Dartmoor, etc., must be applied in submission to the harmony of the laws of Nature—"No violence knows she."

But it is a well-established fact that the summer months spent on Dartmoor give, in their physical and psychical influences, a renewal of life to the faltering vital energies. This is especially so to those in the hovering failures of vital energy of prephthisis.

My experience of the streams of prephthisis and phthisis which

pass before me, both in the correlations of structure and function, in their atavism and alternation, recalls the words of Goethe:

> "Oh, how the spell before my sight
> Brings Nature's hidden ways to light!
> See! all things with each other blending—
> Each to all its being lending—
> All on each in turn depending—
> * * * * *
> While everywhere diffused is harmony unending."

CONFERENCE OF SANITARY AUTHORITIES.

A Conference of Sanitary Authorities has been convened by the Lord Mayor of Liverpool, to be held from July 15-21, in Liverpool. We have been asked to publish a copy of the letter of invitation sent to the various Urban and Rural Sanitary Authorities:

Town Hall, Liverpool,
May, 1903.

My dear Sir,

I have the honour to inform you that a Conference of Sanitary Authorities will be held in this city from July 15 to 21 next.

You are doubtless aware that the Annual Congress of The Royal Institute of Public Health is also to be held in this city on coincident dates, and it is felt that the presence of so many eminent sanitarians and members of Sanitary Authorities affords an exceptional opportunity of holding such a Conference.

I trust that your Council will appoint Representatives to attend the Conference, and take part in the proceedings.

Matters of great importance in connection with Municipal Hygiene and Engineering, Sanitation of Congested Areas, and other allied subjects, will be discussed, and a detailed programme will be drawn up later.

Full opportunities will be given to Delegates to inspect and investigate the various Sanitary operations and Municipal undertakings carried on in the City.

Arrangements have been made whereby Delegates coming to the Conference may join in the proceedings of the Congress of The Royal Institute.

A subscription of one guinea will be charged to each Delegate attending, and in addition to the foregoing arrangements, this will entitle him to a Copy of the Proceedings and a well-illustrated Handbook descriptive of the Municipal work carried on in the City and Port, the Shipping of the Port, and other interesting matter.

I enclose a form upon which the names and addresses of Delegates may be entered.

I am,
Yours faithfully,
W. Watson Rutherford,
Lord Mayor.

A HOSPITAL FOR OPHTHALMIA.

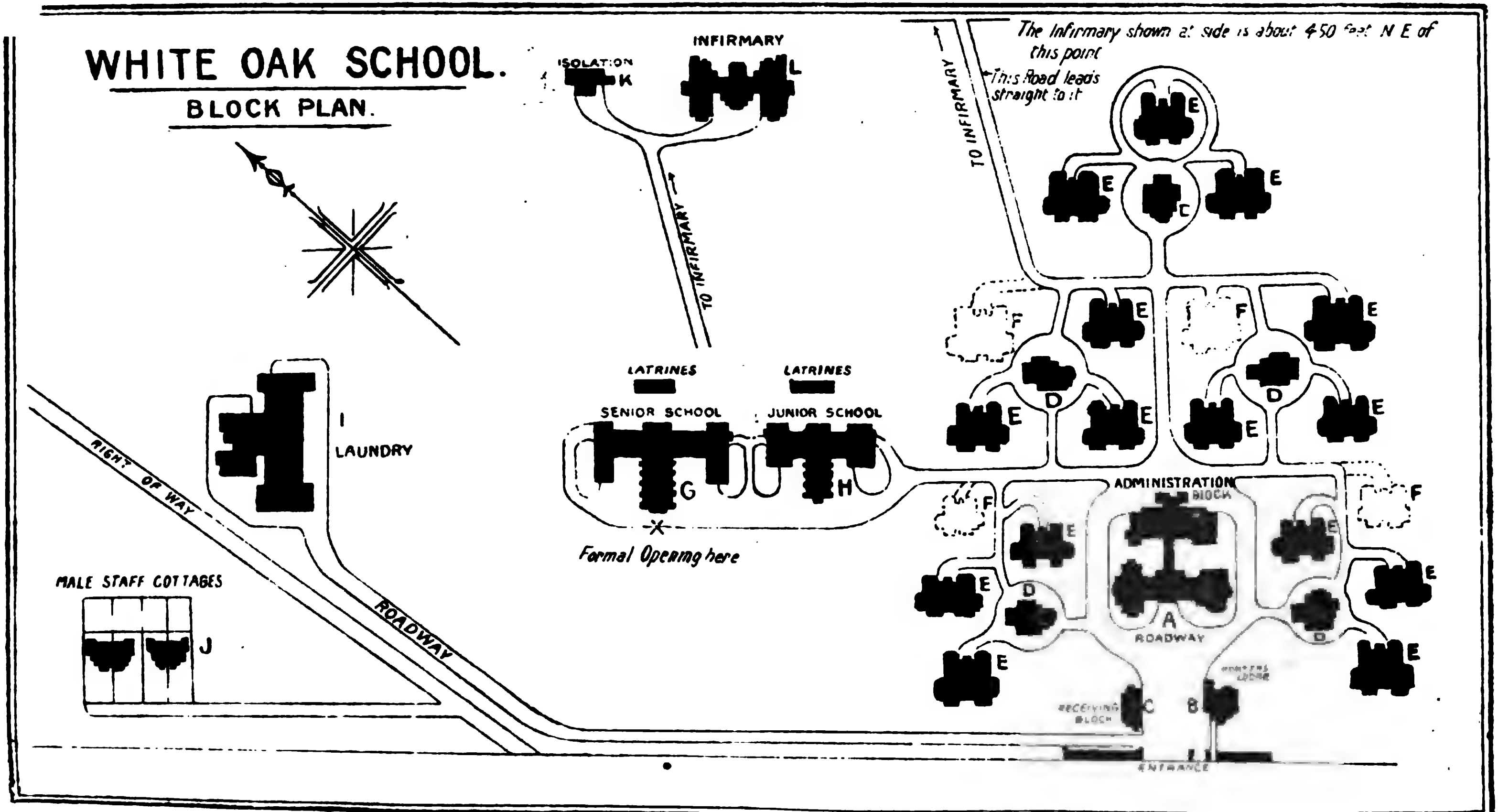
THE institution known as the White Oak School, at Swanley, recently erected by the Metropolitan Asylums Board for cases of ophthalmia, was on May 23 formally opened for the reception of such cases from the various Poor Law districts of London.

The existence of ophthalmia in Poor Law schools has been the subject of several special reports by medical experts from the year 1858 onwards; and while those reports show that much has been done to mitigate the prevalence of the disease, they make it clear that the disease fluctuates a good deal, and that it must not be concluded, because there has been a great diminution in the prevalence and severity of the complaint, that its recrudescence is an improbability.

Every medical expert who has issued a report on the matter has recommended the provision of isolation schools as the only certain cure, and yet (except for the action of the North Surrey District Board, who more than twenty years ago made a temporary provision for the children of that district) it was not till 1889 that anything definite was done, in which year a well-organized but partial attempt was made by the Central London School District Board at Hanwell to put the recommendation into practice.

The importance of carrying into full effect this suggestion as to isolation of afflicted children will be apparent when regard is had to the fact that, though many cases are imported into the schools (more than 11 per cent. of those seeking admission were found to be suffering from ophthalmia), yet not a few children who entered the schools with healthy eyes have afterwards contracted the disease there.

Nor does one attack render the patient immune—rather the reverse; for many children have had, not one attack only, but several. One of the medical witnesses informed the Poor Law Schools Committee that, out of 880 children who in one year were afflicted at one school, only 160 were suffering from their first attack; more than three fourths had had the disease twice or oftener, and some more than ten times.



A Administration Block
B Gate Porter's Lodge
C Receiving Block Ophthalmoscopic Room
D Staff Blocks.
E Double Cottages
F Sites for Extensions
G Senior School
H Junior School
I Laundry
J Male Staff Cottages.
K Isolation Cottage
L Infirmary

Naturally, the eyes of many of the children were thus permanently injured. Moreover, the compulsory withdrawal of the children from attendance at school, so often and in such considerable numbers, had the effect of disorganizing the classes, so that not only was the education of the patients themselves stopped during the continuance of the disease—often a question of years—but the education of the healthy children was seriously interrupted.

As a result of the consideration of the subject by the Departmental Committee on Poor Law Schools in 1896, the duty of making provision for children suffering from ophthalmia was placed upon the Metropolitan Asylums Board by order of the Local Government Board in 1897.

The site of 49 acres at Swanley was purchased in December, 1897, at a cost of £5,050. The settlement of the plans, however, naturally occupied a very considerable period, the schools being a new departure, and following no existing model. The buildings had to be planned to serve both as a school and a hospital, while not being too expensive in either capacity, and the time and thought given to the preparation of the detailed plans by both the Metropolitan Asylums Board and the Local Government Board have been of the greatest benefit to the scheme. The tender accepted in February, 1901, for the erection of the buildings was £112,324.

At the entrance is the gate-porter's lodge and the receiving block, with ophthalmoscopic room and laboratory.

There are thirty cottages for children, arranged in fifteen pairs, and in five groups of three pairs. Each cottage accommodates twelve children and a house-mother. In connection with each of the five groups is a small staff block, containing a room for the medical treatment of the seventy-two children in the group, and quarters for the charge-nurse, who supervises the group and carries out this treatment, a cook-general, and a general servant. The heavier part of the cooking for the group is done in this block.

The central administration block contains quarters for the

matron, assistant matron, domestic and laundry staff, extra nurses, storekeeper's office, general stores and needle-room.

The other buildings include the junior school, the senior school (with special room for ophthalmic surgeon), the laundry, four cottages for male staff, infirmary, and isolation cottage.

At the present time various forms of ophthalmia of very different degrees of severity have been admitted, and consequently in different cases different treatments are being employed.

Those from whose eyes there is much discharge are having the eyelids brushed with a solution of nitrate of silver. There are several cases of what are called "trachoma," in which the lids are being touched with sulphate of copper. In some of the mild cases of ophthalmia a perchloride of mercury or sulphate of zinc drops are being used.

Treatment with the X rays and with high-frequency currents has been tried in some cases, and will be given a more extended trial when the dynamo for charging the batteries, which has been ordered, is obtained.

In certain cases operative procedures for removal of granulations have been resorted to.

THE recent case in which the Medical Officer of Health for Bury, Dr. Brindley, was sued in the County Court by the parent of a child whom he vaccinated in circumstances of utmost urgency which precluded the consultation of her parents, has drawn attention to the need which exists in the interests of the medical profession and of the public, for defining the limits of "technical assaults" and the rights of parents to inferfere at critical periods with medical treatment on grounds other than those purely scientific.

BACTERIOLOGICAL NOTES.

I.

THE ÆTIOLOGY OF SLEEPING SICKNESS.

BY

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Sleeping sickness is a remarkable disease, limited, so far as is known, to certain regions of Africa, especially in the district of the Lower Congo. Recently it has been spreading to the Upper Congo, towards the Victoria Nyanza, and to the upper waters of the Nile. It is thus approaching, and may become a menace to civilization viâ the Nile and Egypt. The disease has been causing a large mortality, and thousands are said to have died; when once a person is attacked the prognosis seems to be hopeless. It comes on insidiously; the patient becomes listless and morose, and after a variable period of weeks or months there is a feeling of lassitude and disinclination for work, and liability to fall asleep. The last-named feature increases, and ultimately the patient sleeps continually, but can be roused for a short time. He subsequently takes to his bed, becomes comatose, and the end is brought about by an attack of convulsions or gradual asthenia.

As regards the pathological appearances, the condition seems to be one of chronic meningo-encephalitis akin to that met with in general paralysis of the insane.*

The first surmise with regard to the ætiology of this affection was made by Manson, who found present in the few cases he examined a species of blood filaria, the *Filaria perstans*, and suggested that this organism, by blocking the cerebral capillaries, etc., might be the cause. The recent work of Low,† however, seems to have disproved this theory, as he has found that the geographical distribution of this filaria does not correspond with that of the disease.

* Manson and Mott, *Trans. Path. Soc., Lond.*

† *Brit. Med. Journ.*

A Portuguese Commission which investigated the disease in 1902 found present in the cerebro-spinal fluid, the exudate from the lateral ventricles, the blood, ganglia, etc., a micro-organism which they describe as being intermediate in its characters between the streptococcus and the *Diplococcus pneumoniæ*, and termed a "diplostreptococcus" or "hypnococcus." It is separated from the *Diplococcus pneumoniæ* by its capacity for developing on nutrient gelatin at a temperature below 24° C.

Subsequently an English Commission, consisting of Drs. Low, Castellani, and Christy, was sent to Central Africa to study the disease by the Royal Society and the London School of Tropical Medicine. Low* investigated the distribution of the *Filaria perstans*, with the result detailed above. Castellani† isolated from the cerebro-spinal fluid, etc., a micro-organism which he regarded as a streptococcus, and which he believed to be different from the microbe obtained by the Portuguese. In all probability the two organisms are identical, the slight differences between them being due to differences in technique, in the culture media, etc. Small differences of this kind may materially alter the appearances of cultures.

More recently Castellani‡ has found in the cerebro-spinal fluid taken by lumbar puncture during life, in twenty out of thirty-four cases examined (70 per cent.), the form of protozoan parasite known as a trypanosoma. A trypanosome has a somewhat spindle-shaped, flexible, protoplasmic body, containing usually two nuclei, a larger and a smaller, and a vacuole, the posterior extremity being pointed, the anterior being prolonged into a single flagellum.

On two occasions this trypanosome was found in the fluid of the lateral ventricles, and once in the blood. Since then Colonel Bruce, F.R.S.,§ who is now in Central Africa continuing Castellani's investigations, has found the trypanosome in the cerebro-spinal fluid in every one out of thirty-eight cases of

* See *Brit. Med. Journ.*, 1903, i., p. 908.

† See *Brit. Med. Journ*,

‡ Paper read before Royal Society, May 14; also *Brit. Med. Journ*, 1903, i., p. 1431.

§ Royal Society, May 14, 1903.

sleeping sickness examined, and in the blood in twelve out of thirteen cases.

The only other human trypanosome known is that which occurs in the disease termed "trypanosomiasis," which is characterized by febrile attacks, enlarged spleen, and transient œdema and erythema. Castellani considers that the trypanosome of sleeping sickness is morphologically different from the trypanosome of trypanosomiasis, for it seems to be less active, the micro-nucleus lies near the extremity, and the vacuole is larger than in the last-named species (*T. Gambiense*). He suggests that sleeping sickness is due to invasion by a trypanosome, and that in the later stages there is a concomitant streptococcal infection.

This trypanosome is not present in large numbers in sleeping sickness, and in order to demonstrate them it is necessary to draw off 15 c.c. of the cerebro-spinal fluid. It is better to reject the first few c.c., as they are apt to contain blood. When the fluid comes away clear, 10 c.c. are collected and centrifugalized for ten minutes. At the end of this time there will be a slight deposit in the tube; the liquid above is poured off, and this deposit is examined under a moderately low power. The trypanosomes will be in active movement, and are easily detected.

II.

BACTERIOLOGICAL NOTES FROM FOREIGN JOURNALS.

THE PREPARATION OF LOEFFLER'S BLOOD-SERUM PLATES FOR DIPHTHERIA BACILLI.—In the preparation of Loeffler's blood-serum we found the method first proposed by Miss Carter (*Journ. App. Mic.*, April, 1898), and subsequently recommended by Dawson (*Journ. App. Mic.*, October, 1899), most satisfactory. The surprise is that it is not generally recommended in text-books. It is certainly admirably adapted, especially to class work. One point about getting perfectly white serum. The usual recommendation of using the serum after it has stood for twenty-four to forty-eight hours does not give satisfactory results, as the serum will always be somewhat coloured. A better practice is to put the serum drawn off at the end of forty-eight hours into a

well-stoppered bottle, add a little chloroform, and let it stand for weeks and even months. In time the blood corpuscles subside, leaving a perfectly clear serum. This, when coagulated, is as white as the white of an egg. The chloroform is removed by heating the serum to be used at 56° C. for thirty minutes. For the isolation of diphtheria bacilli the following method will prove fairly satisfactory: Round, flat flasks containing Loeffler's blood-serum mixture are placed in the coagulator or sterilizer on a perfectly horizontal plane, and the serum coagulated. It then presents a perfectly white, smooth surface. The swab is run lightly over this surface, and the flasks inoculated, bottom side up, for eighteen to twenty-four hours. At the end of that time any colonies which have appeared on the surface are removed by means of a platinum needle with the point bent at a right angle and examined. The minute colonies which appear at this time of incubation are, as a rule, either micrococci or diphtheria bacilli. By examining several colonies the right colony may be finally discovered. The reason for using flasks instead of plates, although the latter are more convenient, is that the flasks can be hermetically sealed by means of the paraffin stoppers and kept ready for use.

A Precaution as to the Use of Fuchsin for Staining Tubercle Bacilli. A. Robin.—In the course of our routine examination of sputum for tubercle bacilli we had occasion to use by mistake carbol fuchsin prepared from acid fuchsin or "Fuchsin S" (Gruebler). We found that the tubercle bacilli, when present, are but faintly stained; that other bacteria retain the stain after decolorization; and that when the specimen is counterstained, the tubercle bacilli are readily overlooked. This fact had been established by making comparative preparations stained with acid fuchsin and basic fuchsin. The precaution is that in making carbol fuchsin the basic dye alone should be used.

Formalin or other Fixing Vapour, followed by Absolute Alcohol, as a Wet Method for Blood Films. G. Scott. (*Journ. of Pathology and Bacteriology*, vii., 131-136, 1901.)—According to Brinckerhoff and Tyzzer and Professor G. Sims Woodhead, this method gives excellent results:

1. Hold the wet film, wet side down, in the mouth of a wide bottle, half filled with ordinary 40 per cent. solution of formic aldehyde, for about five seconds.

2. Drop, still wet, film side downwards, into absolute alcohol. Leave fifteen minutes, or, if more convenient, as long as forty-eight hours.

3. Blot off excess of alcohol, and move cover-glass to a dry part of the blotting-paper.

4. Immediately, before any drying occurs, drop on a few drops of eosin-methylene blue stain (Jenner's stain); cover with a watch-glass; stain for two minutes, no longer.

5. Allow excess of stain to run off the cover-glass, and rinse at once in a bowl of distilled water.

6. Blot off excess of water.

7. Dehydrate very rapidly in absolute alcohol, merely dipping in and withdrawing as quickly as possible.

8. Wash off alcohol in first xylol rapidly; wash in second xylol; drop on fresh xylol.

9. Mount in xylol balsam.

Scott insists upon the importance of using only pure distilled water to wash off excess of stain and cover-slips which are quite free from acid. The blood film must not be allowed to dry at any stage.

An Inquiry into the Rôle of Domestic Animals in the Causation of Typhoid Fever. William R. Stokes. (*Maryland Med. Journ.*, 1900.)—The author undertakes to determine how far some of the common domestic animals may be concerned in the distribution of the typhoid bacillus. For this purpose he uses chickens, white rats, rabbits, guinea-pigs, calves, and pigs. In all cases he has fed the typhoid bacillus in considerable quantity to the animal, and at varying intervals has studied the fæces for the purpose of disclosing, if possible, the presence of typhoid bacillus. He finds that the typhoid bacillus disappears with extreme rapidity in the intestine of these animals and in the fæces; from none of them is he able to isolate living typhoid bacilli. He concludes, therefore, that the dejecta of these animals play no very great part in the distribution of typhoid fever.

CHEMICAL NOTES.

The Volumetric Determination of True Casein and other Proteids in Milk. G. Denigès. (*Bull. Soc. Pharm. Bordeaux*, October, 1902; *Ann. de Chim. anal.*, 1903, viii., 98-100.) —This is an extension of the author's volumetric method. Twenty-five c.c. of the milk are shaken with 1 c.c. of a 30 per cent. solution of potassium oxalate, and then treated with 20 c.c. of a solution of 13·55 grammes of mercuric chloride and 36 grammes of potassium iodide in a litre, followed by 2 c.c. of glacial acetic acid. After dilution to 200 c.c. the liquid is filtered, and 100 c.c. treated with 10 c.c. of potassium cyanide solution, equivalent to $\frac{N}{10}$ silver nitrate solution and 15 c.c. of ammonium hydroxide, and titrated with $\frac{N}{10}$ silver nitrate solution until a permanent turbidity appears. The difference between the number of c.c. used and 48 gives a value corresponding with the total amount of proteids in grammes per litre of milk.

To obtain the proteids not precipitated by acetic acid, 50 c.c. of the milk are diluted with about 180 c.c. of water, and, after the addition of 0·2 c.c. of glacial acetic acid, made up to 250 c.c. and filtered, and the proteids in 125 c.c. (=25 c.c. of milk) determined as above. The difference between the two results gives the amount of true casein in a litre of the milk.

Estimation of Sugar in Chocolate. A. Steinmann. (*Schweiz Wochenschr. Chem. Pharm.*, 1903, xli., 65; *Chem. Zeit. Rep.*, 1903, 56.)—In the original the author gives certain tables, by the aid of which the proportion of sugar present can be calculated from an observation of the specific gravity of the aqueous extract of the chocolate, and from the opticity of the liquid after decolorization with lead acetate. A correction is also made for the error introduced by the volume of the lead precipitate. The extract is prepared by shaking 50 grammes of the rasped sample with 200 c.c. of cold water at intervals for four hours, then filtering. The entire process is not complicated, and is stated to give concordant results.

Occurrence of Salicylic Acid in Fruits. F. W. Traphagen and Edmund Burke. (*Journ. Amer. Chem. Soc.*, xxv., 242.)—A

number of fresh fruits were examined for salicylic acid by distilling the fruit with phosphoric acid, extracting the distillate with ether, evaporating the extract, and adding ferric chloride after taking up the residue in water. The quantities found in this way, which were exceedingly small (fractions of a milligramme per kilogramme of fruit), are not absolute, but only comparative, and represent the amounts the authors succeeded in extracting; they are important in view of the use of salicylic acid as a food preservative. The fruits from which salicylic acid was obtained were: strawberries, red and black raspberries, blackberries, currants, plums, black cherries, apricots, peaches, Concord grapes, crab-apples, standard apples, and oranges. The acid is probably present as the methyl ester.

DETECTION OF HYDROGEN PEROXIDE IN MILK. C. ARNOLD AND C. MENTZEL. (*Zeit. für Untersuch. der Nahr. und Genussmittel*, 1903, vi., 305-309.)—As hydrogen peroxide is sometimes used as a preservative of milk, the authors have investigated the various reactions for its detection. In the case of raw milk the para-phenylendiamine test was found to be the most sensitive, it being possible to detect as little as 0·0025 gramme of hydrogen peroxide in 100 c.c. of milk by this reaction. It is also applicable to heated milk, but as the reaction only takes place in the presence of oxydase, a little raw milk must be added to the sample of heated milk under examination. A reaction, independent of the presence of oxydase, and consequently suitable for the detection of hydrogen peroxide in both raw and heated milk, consists in adding to 10 c.c. of the sample about 10 drops of a 1 per cent. solution of vanadic acid in dilute sulphuric acid. A red coloration is produced by the presence of 0·01 gramme of hydrogen peroxide in 100 c.c. of milk. Titanic acid dissolved in dilute sulphuric acid gives a yellow coloration with 0·015 gramme of hydrogen peroxide. The milk should be tested as soon as possible after the sample is received.

THE COMPOSITION OF PROCESS OR RENOVATED BUTTER. CHARLES A. CRAMPTON. (*Journ. Amer. Chem. Soc.*, xxv., 358.)—The raw material, or so-called "stock," for the manufacture of

renovated butter, which is now taxable in the United States at ¼ cent per pound, is butter which is unfit for direct sale owing to rancidity, mould, or unskilful preparation. This material is melted and allowed to settle, after which water and curd are removed from the fat, which is next aerated or "blown" with air, and sometimes washed with water. It is claimed by the makers that no chemicals are used to deodorize the fat. After adding fresh milk, which has been inoculated with a bacterial culture, to the fat, the whole is chilled and granulated in ice-water, churned, and prepared for the market as usual for butter.

The tests used in the identification of renovated butter are: The appearance of the fat when viewed by polarized light (Brown-Taylor-Richards test, *Journ. Amer. Chem. Soc.*, xxii., 703); the behaviour of the fat when boiled in an open vessel ("spoon" test); the granulation of the fat when cooled in milk (Waterhouse test, *Proc. Assoc. Official Agric. Chem.*, 1901, 126, and *U.S. Dep. of Agric.*, *Farmer's Bulletin*, No. 131).

The chemical data obtained in the examination of seventy-five samples of renovated butter in no way serve to discriminate between fresh and renovated butter.

The physical tests on the melted fat appear so far to be the best means of identification of renovated butter, but occasionally they fail to yield positive results.

DETERMINATION OF SUGAR IN CHOCOLATE. P. WELMANS. (*Zeit. für öffentl. Chem.*, 1903, ix., 93-101, and 115-120.)—Ten grammes of the finely-divided chocolate are shaken in a separating funnel with 100 c.c. of water-saturated ether until all fat is dissolved. One hundred c.c. of ether-saturated water are then added, and the shaking continued for some time. When separation has taken place, the fat is determined in an aliquot portion of the ether layer. Fifty c.c. of the aqueous layer are then transferred to a 55 c.c. flask, 2 c.c. of lead acetate solution are added, and water up to the mark. After filtering the solution is polarized, and the amount of sugar calculated from the reading obtained.

LEGAL NOTES.

KING'S BENCH DIVISION.

FINDLEY *v.* HAAS.

In this case the appellant, Findley, was a constable in the East Riding Police Force, who, having been appointed by the Chief Constable to take samples under the Sale of Food and Drugs Acts (38 and 39 Vict., c. 63; 42 and 43 Vict., c. 30), purchased from the respondent at the Royal Oak Inn, Paull, one pint of brandy, and, having duly served her with a notice under the Acts stating that the brandy was purchased for the purpose of analysis by the Public Analyst, divided the sample into three parts in her presence, delivering one to her properly sealed, transmitting another, properly sealed, to the Public Analyst for the East Riding, and retaining in his possession and producing in court the third part.

The Public Analyst gave the following certificate of analysis, which was put in evidence at the trial before the justices:

"SALE OF FOOD AND DRUGS ACT, 1875.

"*To* MR. J. FINDLEY.

"I, the undersigned, Public Analyst for the East Riding of Yorkshire, do hereby certify that I received on the 5th day of March, 1902, from you a sample of brandy, No. 9, for analysis, and have analyzed the same, and declare the result of my analysis to be as follows:

"I am of opinion that the said sample contained the parts as under, or the percentage of foreign ingredients as under:

"It has been reduced from 25 degrees under proof to 27·6 degrees under proof.

"Observations.

"Holderness Division.

"As witness my hand this 10th day of March, 1902.

"JAMES BAYNES."

At the hearing of the summons it was contended on behalf of the respondent that this certificate should have specified the total quantity of pure spirits and of added water or other ingredients, if any, contained in the sample, and was for this reason neither in form nor in substance sufficient evidence of a contravention of the statute on her part to warrant a conviction. (See Newly *v.* Sims, 1 Q. B. 478.)

For the appellant it was urged in reply that the certificate did comply with the requirements of the Act, did contain information sufficient to enable the justices to decide whether an offence had been committed, and was not vague.

The justices, adopting the contentions of the respondent, dismissed the information and complaint. Question whether the justices upon the above facts came to a correct determination and decision in point of law. If so, the dismissal by them of the information was to stand. If not, the case was to be remitted to them with the opinion of the Court.

Lord ALVERSTONE, L.C.J. (WILLS and CHANNELL, JJ., concurring): "The justices should, on the facts as stated in the case, have convicted. By his certificate the analyst has certified that the sample of brandy submitted to him had been reduced from 25 degrees under proof to 27·6 degrees under proof. Section 6 of the Sale of Food and Drugs Amendment Act, 1879, is as follows: 'In determining whether an offence has been committed under Section 6 of the said Act of 1875,

by selling, to the prejudice of the purchaser, spirits not adulterated otherwise than by the admixture of water, it shall be a good defence to prove that such admixture has not reduced the spirit more than 25 degrees under proof for brandy.' Here the reduction was 27·6 degrees under proof—a greater reduction than that which is laid down as the limit. The analyst's certificate is therefore sufficient."

KYFFIN *v.* SIMMONS.

Bye-laws under Section 94, *London Public Health Act*, 1891.

The respondent, the Sanitary Inspector appointed by the Sanitary Authority of the City of London, laid an information at the Guildhall against the appellant, who was convicted of an offence that, contrary to the third bye-law made by the Sanitary Authority and to the statute, he, the appellant, on May 9, 1902, in the City, at No. 13, Shaftesbury Place, being a house let in lodgings, or occupied by members of more than one family, did knowingly cause or suffer a greater number of persons than would admit of the provision of air-space required for each to occupy at one time as a sleeping apartment a room used exclusively for that purpose. The bye-law requires the provision of 350 cubic feet of free air-space for each person of an age exceeding ten years, and of 175 cubic feet of free air-space for each person of an age not exceeding ten years.

The house, No. 13, Shaftesbury Place, is not specially constructed to be let in separate tenements, and is rated as one hereditament. It has six rooms, three floors, and a basement, one common internal staircase, and a common front-door, always open. There are two rooms on each floor, and each floor is separately let to and occupied by a separate family. There is no separate washing or sanitary accommodation on the several floors, but in the basement the scullery and wash-house, and in the yard, the tap and w.c., are used by the tenants of the several floors in common. The appellant is the landlord of these premises, which are let to different families as ordinary weekly tenants. On the first floor, at 12.42 a.m., in the back-room, a boy, aged eleven, and two girls, each under ten, were in bed. The room was used exclusively as a sleeping apartment, and contained 332 cubic feet of free air-space, as against 700 required by the bye-law. It was proved that the landlord knew the number of people sleeping in the room.

It was contended for the appellant that the house was not a lodging-house within the meaning of the bye-law. Weatheritt *v.* Cautlay, 1901, 2 K.B. 285, cited. The Alderman convicted.

The question was, whether the house came within the scope of the bye-law, which defined lodging-house as meaning "a house or part of a house which is let in lodgings or occupied by members of more than one family."

The court (Lord ALVERSTONE, L.C.J., and WILLS and CHANNELL, JJ.) affirmed the conviction, and distinguished the present from the case Weatheritt *v.* Cautlay, 1901, 2 K.B. 285, on the ground that the magistrate had found, and rightly, as a fact that the house is within the words "house . . . occupied by members of more than one family."

HUDSON *v.* BRIDGE.

In this case the respondent purchased from the appellant, a chemist in Tottenham, 6 ounces of vinegar of squills, and, having paid for it, informed the appellant that it was for an analysis by the Public Analyst, and divided it into three parts, giving one part to the appellant, transmitting one part to the Public Analyst, and retaining the third part himself. The analyst gave the following certificate:

"*To* Mr. Bridge.

"I, the undersigned, Public Analyst for the county of Middlesex, do hereby certify that I received on the 7th day of January, 1902, from Mr. Vernon, a sample of vinegar of squills, E.M. 13, for analysis (which then weighed about 3 ounces), and have analyzed the same, and declare the result of my analysis to be as follows:

"I am of opinion that it is deficient in acetic acid to the extent of 40 per cent. This opinion is based on the fact that the sample contained only 2·5 per cent. of acetic acid, whereas it should have contained at least 4·2 per cent. of acetic acid.

"As witness my hand this 21st day of January, 1902.

"Edward Bevan

"At 4, New Court, Lincoln's Inn, W.C."

The British Pharmacopœia prescribes the method of preparation and the proportion of the constituents of this compounded drug, but not the quantity of acetic acid, though this last is defined, and, as a result, 4·27 of acetic acid is originally brought in as an ingredient. A small but variable quantity of the acid is lost in the process of manufacture. A further gradual diminution of acetic acid takes place, the rate of which varies with the care used in storage, and is due to a form of decomposition, producing a fungoid growth, as well as to evaporation and to acetylation in the presence of glucosides and calcium salts. The whole deficiency of acetic acid in the sample in question might have been due to this decomposition if far advanced, but analysis is not capable of determining whether the deficiency of acetic acid arises from imperfect manufacture or from subsequent diminution.

The function of the acid being to extract the medical properties from the squills, the disappearance of the acetic acid was immaterial.

The appellant contended (1) that while it had been proved that vinegar of squills was liable to decomposition, the analyst's certificate contained no note stating whether any change had taken place in the constitution of the article which would interfere with the analysis, and that therefore the analyst's certificate did not conform to the requirements of the Sale of Food and Drugs Act, 1875; (2) that there was no evidence to show that there was a sale to the prejudice of the purchaser, or that the quantity of acetic acid remaining after manufacture was material; and (3) that there was no evidence of any standard of quality of vinegar of squills, or of any standard quantity of acetic acid being recognised in vinegar of squills.

On the part of the respondent it was urged and accepted by the justices that (1) the analyst's certificate was valid and in accord with the provisions of the Sale of Food and Drugs Act, 1875, because vinegar of squills, while liable to decomposition, is not liable to decomposition within the meaning of the schedule to the Sale of Food and Drugs Act, 1875. (2) That a standard for the quantity of acetic acid to be present in vinegar of squills as prepared according to the British Pharmacopœia can be approximately fixed by inference and is within the limits of 3·8 and 4·2 per cent. (3) That no appreciable diminution of acetic acid contained in the drug took place after the sale and prior to the analysis. (4) That having regard to the deficiency of acetic acid, however arising, the drug sold was not compounded in such proportions as demanded by the purchaser, and the sale was therefore to his prejudice, and it was not material to consider whether the medical properties of the drug were affected by the deficiency. The justices

held that an offence had been proved under the Sale of Food and Drugs Act, and convicted the appellant.

The following questions were referred for the opinion of the court:

1. Were the justices right in holding in the facts stated that the analyst's certificate was valid and sufficient?

2. Were they right in holding in the facts stated that there was a standard for the percentage of acetic acid which should be present in vinegar of squills?

3. Were they right in holding in the facts stated that there was any sale to the prejudice of the purchaser?

The court (Lord ALVERSTONE, L.C.J., WILLS and CHANNELL, JJ.) quashed the conviction.

Lord ALVERSTONE, L.C.J., said: "There are in substance two substantial objections raised to this conviction. The first relates to the view of the justices that the analyst's certificate was valid and sufficient. It is not absolutely necessary to decide this, but this case clearly brings out the importance of compliance with the directions of the statute. I am by no means satisfied that the omission in the analyst's certificate can be cured by his presence, and it is extremely important that in all cases in which the article is liable to decomposition the directions appended to the form should be fulfilled, since it is a statutory condition that a certificate shall be given showing that an offence has been committed.

"The second objection is fatal, and is raised in a twofold manner. The justices have clearly excluded from their consideration a matter which they ought certainly to have considered, the materiality of the presence of the element acetic acid in the vinegar of squills. This conviction cannot be supported, because the hypothetical standard which the justices have set up for the purpose of considering whether an offence had been committed is not the standard which ought to be set up in favour of a purchaser who asks a chemist to supply him with vinegar of squills."

WILLS, J., said: "I do not think it is a proper certificate if, when the analyst knows that the substance is liable to decomposition, he fails to do in his certificate what the Act of Parliament requires—namely, to make a statement one way or the other, upon which would depend the question of whether an offence is or is not shown under the Act."

CHANNELL, J., said: "If this certificate had been relied on as the sole evidence, it would undoubtedly have been insufficient, but I do not give any judgment upon the point whether it was a mere defect which might be cured by applying parole evidence. The magistrates misunderstood the words 'interfere with the analysis.' They mean really to prevent the analysis being effective for the purpose of showing what the constitution of the article was at the time of sale."

THE ROYAL INSTITUTE OF PUBLIC HEALTH.

REPORT OF THE COUNCIL.

A MEETING of The Council of The Royal Institute of Public Health was held at 19, Bloomsbury Square, W.C., on June 24, 1903, the President, Professor William R. Smith, M.D., in the chair. Present: F. W. Alexander, Esq., E. G. Annis, Esq., H. Beale Collins, Esq., W. A. Bond, Esq., M.D., Professor R. T. Hewlett, M.D., G. Millson, Esq., H. W. Roberts, Esq., W. T. G. Woodforde, Esq., M.D., Colonel W. F. Ruttledge, R.A.M.C., Treasurer, and James Cantlie, Esq., M.B., Hon. Secretary.

Letters of regret at their inability to attend were read from Professor John Glaister, M.D., Alexander Johnston, Esq., M.D., Herbert Littlejohn, Esq., M.B., and E. W. Snell, Esq., M.D.

The minutes of the last meeting were read and confirmed.

The Finance Committee reported—

That the balance at the bank and on deposit of the General Account, after the payment of all outstanding liabilities, was £769, and that they recommended that a sum not exceeding £500 be invested on mortgage on freehold property if such be obtainable.

The recommendation was adopted.

The Executive Committee reported—

That they had arranged to give courses of health lectures in the following county boroughs: Barrow-in-Furness, Blackpool, Chester, Lincoln, Oldham, Reading, St. Helens, Stockport, Worcester, and York.

The Harben Nomination Committee reported—

That they had nominated Professor J. McFadyean, M.B., Principal of the Royal Veterinary College, London, to be the Harben Lecturer for 1904.

The nomination was approved.

The President reported that he had written a letter of regret at the death of His Eminence Cardinal Vaughan, an Honorary Fellow.

The Secretary had acknowledged the letter in the following terms:

"*With grateful thanks for the most kind letter of condolence written on behalf of the Fellows and Members of The Royal Institute of Public Health.*"

The Council then considered their annual report, which was ordered to be printed (*vide* p. 421).

The Council then proceeded to consider the nomination of officers and Council for the year 1903-1904, to be submitted to the Annual Meeting, which was fixed for July 21, in Liverpool (*vide* p. 423).

The following were elected Members of The Institute:

As Fellows:

Major GOFTON GEE ADAMS, M.R.C.S., R.A.M.C.
JAMES BEATTY, M.D., D.P.H., Medical Officer of Health, Northampton.
MARTYN CECIL BEATTY, M.B. Edin., Lieutenant, R.A.M.C.
JOSEPH WILLIAM DAWES, M.B., Medical Officer of Health for Longton.
Major JOHN JOSEPH GARRARD, M.B. Dub., R.A.M.C.
HERBERT ASTLEY KNIGHT, M.B. Edin., D.P.H.
RICHARD LORD, M.D., London.
JOHN ORTON, M.D., D.P.H., Medical Officer of Health, Foleshill Rural District.
Major ROBERT CHRISTIE THACKER, L.R.C.S.I., R.A.M.C.
ALFRED ERNEST WALKER, M.R.C.S., D.P.H.

As Members:

HORATIO BREVITT, Town Clerk, Wolverhampton.
JOSEPH HENRY FIELD, LL.B., Town Clerk of Huddersfield.
ENOCH MATHER, M.D.
CHARLES PRESTON, Town Clerk, Barrow-in-Furness.
ARTHUR STEELE SHELDON, Town Clerk, Burnley.
HIGSON SIMPSON, Town Clerk, West Hartlepool.
FREDERICK JOHN TANNER, Esq., Bacteriologist to the Borough of Bournemouth.

As Associates:

ERNEST ALEXANDER BEAUMONT, Esq., A.C.A., Huddersfield.
WILLIAM HENRY CLARKE, Esq., Coventry.

(*Signed*) JAMES CANTLIE,
Hon. Secretary.

June 24, 1903.

NOMINATION OF OFFICERS AND COUNCIL, 1903-1904.

President:

Professor WILLIAM R. SMITH, M.D., D.Sc., F.R.S. Edin., J.P., Barrister-at-Law, Professor of Forensic Medicine and Director of the Laboratories of State Medicine in King's College, London.

Vice-Presidents:

Sir CHARLES ALEXANDER CAMERON, C.B., M.D., F.R.C.P.I. (Hon.), D.P.H. Camb., Professor of Chemistry and Hygiene to the Royal College of Surgeons of Ireland; Chief Medical Officer of Health to the City of Dublin, etc.

Sir JOSEPH FAYRER, Bart., K.C.S.I., M.D., LL.D., F.R.S., etc., Honorary Physician to H.M. the King; late Physician to the Secretary of State for India in Council.

Professor Sir HENRY DUNCAN LITTLEJOHN, M.D., LL.D., Consulting Medical Officer to the Local Government Board for Scotland; Medical Officer of Health to the City of Edinburgh, etc.; Professor of Medical Jurisprudence in the University of Edinburgh.

(The above are elected for life.)

Sir JOHN SIMON, K.C.B., LL.D., D.C.L., F.R.S., etc., Late Medical Officer to H.M.'s Privy Council.

Surgeon-General Sir WILLIAM TAYLOR, M.D., K.C.B., K.H.P., Director-General of the Army Medical Staff.

Surgeon-General Sir WILLIAM R. HOOPER, K.C.S.I., Physician to the Secretary of State for India in Council.

Sir HENRY FREDERICK NORBURY, K.C.B., M.D., Medical Director-General of the Navy.

Surgeon-General Sir BENJAMIN FRANKLIN, K.C.I.E., K.H.P., Director-General of the Indian Medical Service.

Colonel Sir JAMES R. ANDREW CLARK, Bart., C.B., F.R.C.S. Edin., Militia Medical Staff Corps.

Veterinary Colonel H. THOMSON, C.B., Director-General, Army Veterinary Department.

Professor W. O. WILLIAMS, F.R.C.V.S., F.R.S.E., President of the Royal College of Veterinary Surgeons.

Treasurer:
Colonel W. F. RUTTLEDGE, R.A.M.C., Aldershot.

Hon. Counsel:
A. MACMORRAN, Esq., K.C.

Hon Solicitor:
HENRY C. JONES, Esq.

Hon. Auditor:
M. HEYES, Esq., C.A.

Hon. Secretary:
JAMES CANTLIE, Esq., M.B., F.R.C.S.

Council:

ENGLAND.

F. W. ALEXANDER, Esq., L.R.C.P., D.P.H., Medical Officer of Health for Poplar.

BUSHELL ANNINGSON, Esq., M.D. Cantab., Medical Officer of Health for Cambridge, etc.; Lecturer on Medical Jurisprudence in the Cambridge Medical School.

E. G. ANNIS, Esq., L.R.C.P., D.P.H., Medical Officer of Health for Greenwich.

W. A. BOND, Esq., M.A., M.D., Medical Officer of Health for Holborn.

RICHARD KING BROWN, Esq., B.A., M.B., D.P.H., Medical Officer of Health for Bermondsey.

Major ROBERT CALDWELL, R.A.M.C., Aldershot.

H. BEALE COLLINS, Esq., M.R.C.S. Eng., D.P.H., R.C.P. and S. Eng., Surgeon R.N. (retired), Medical Officer of Health for Kingston-on-Thames.

Major R. FIRTH, R.A.M.C., London.

F. DREW HARRIS, Esq., M.B., D.P.H., Medical Officer of Health for St. Helens.

EDWARD WILLIAM HOPE, Esq., M.D., D.Sc., Medical Officer of Health for the City of Liverpool, and Professor of Public Health in University College, Liverpool.

Lieutenant-Colonel H. E. R. JAMES, R.A.M.C., Aldershot.

JOHN WRIGHT MASON, Esq., M.B., D.P.H. Aberd., Medical Officer of Health for Hull.

GEORGE MILLSON, Esq., L.R.C.P., Medical Officer of Health for the Borough of Southwark.

Henry William Roberts, Esq., M.R.C.S., Medical Officer of Health for the Borough of Deptford.

Major Ronald Ross, C.B., F.R.C.S., F.R.S., Liverpool School of Tropical Medicine.

Professor W. R. Simpson, M.D., F.R.C.P., Professor of Hygiene in King's College.

Daniel Lewis Thomas, Esq., M.R.C.S. Eng., D.P.H., Medical Officer of Health for Stepney.

Hugh Ernest Snell, Esq., M.D., D.P.H., Medical Officer of Health for Coventry.

Francis Vacher, Esq., M.R.C.P. Edin., Medical Officer of Health for the County of Cheshire.

William Thomas Garrett Woodforde, Esq., M.D., Medical Officer of Health for the Berkshire Combined Districts.

Scotland.

Ebenezer Duncan, Esq., M.D., late President of the Sanitary Association for Scotland.

John Glaister, Esq., M.D., D.P.H. Camb., Professor of Medical Jurisprudence in the University of Glasgow.

Matthew Hay, Esq., M.D., Professor of Medical Jurisprudence in the University of Aberdeen; Medical Officer of Health for Aberdeen.

Alexander Johnston, Esq., M.D., D.P.H. Glasgow.

Henry Harvey Littlejohn, Esq., M.A., M.B., D.Sc. Edin., Lecturer on Forensic Medicine, Surgeons' Hall, Edinburgh.

James Maxwell Ross, Esq., M.B., B.Sc., Medical Officer of Health for Dumfriesshire.

Sir James Alexander Russell, M.B., LL.D., B.Sc., late Lord Provost of Edinburgh.

James Burn Russell, Esq., M.D., LL.D., Medical Member of the Local Government Board for Scotland.

Ireland.

Samuel Agnew, Esq., B.A., M.D., Medical Officer for the Town of Lurgan.

George Patrick Cope, Esq., L.R.C.P. Irel., Medical Officer of Health for No. 3 District of Dublin.

Edgar Flinn, Esq., F.R.C.S. Irel., Medical Inspector of the Local Government Board for Ireland.

Professor Edward Joseph McWeeney, M.D., D.P.H., Bacteriologist, Local Government Board, Ireland.

Henry William Oulton, Esq., M.D., Medical Officer of Health for No. 1 District of Dublin, Hon. Sec. for Ireland.

Professor Antony Roche, M.D., Dublin.

Professor Charles R. C. Tichborne, LL.D., D.P.H., R.C.S. Irel., Member of the General Medical Council.

Isaac William Usher, Esq., L.R.C.S., Medical Officer of Health for Rathdown.

Henry Whitaker, Esq., M.D., D.P.H. R.C.S. Irel., Chief Medical Officer of Health to the City of Belfast.

BIRTHDAY HONOURS.

We note with satisfaction that Patrick Manson, M.D., F.R.S., has been created K.C.M.G. in recognition of his work in Tropical Diseases, and Surgeon-General G. J. H. Evatt, P.M.O. 2nd Army Corps, has been made a C.B.

REPORT OF THE COUNCIL FOR THE YEAR 1902-1903.

THE Council, in presenting their report for the year 1902-1903, beg to congratulate the Fellows and Members upon the continued success of The Royal Institute of Public Health. During the year 103 new members have been elected, and there have been 36 deaths or resignations, leaving a membership of 1,100.

The Council, after full consideration, decided to extend the usefulness of The Institute by organizing courses of lectures by eminent sanitarians in three selected Metropolitan boroughs on the lines of the Gilchrist Lectures. This effort was attended by such satisfactory results that it has been determined to extend the scheme to the provinces, and the boroughs of Barrow-in-Furness, Blackpool, Chester, Lincoln, Oldham, Reading, St. Helens, Stockport, Worcester, and York were selected, on the application of their respective Councils, as places for the delivery of such lectures during the ensuing winter months.

The Harben Lectures for 1902 were delivered by Major Ronald Ross, C.B., F.R.S., on the subject of "Intermittent Fever," and Professor Ferdinand Hüppe, M.D., of Prague, has been selected as the Harben Lecturer for 1903.

The Harben Gold Medal for 1902 was conferred upon the President, Professor William Robert Smith, M.D., in recognition of his emiment services to the public health for very many years.

In view of legislation on the subject of vaccination, the Council addressed a letter to the President of the Local Government Board urging attention to various points, and they were further represented on a deputation to Mr. Long relative to the matter.

The Council have also urged upon the notice of the President of the Board of Education the necessity for the appointment of a medical adviser to the Board. In these and other ways the Council have endeavoured to promote the public health progress.

The Congress of The Institute for 1902 was held in Exeter, and proved to be most instructive and enjoyable; that for 1903 will

be held in Liverpool, under the Presidency of the Right Hon. the Earl of Derby, K.G.

The Council deplore the death of two eminent Honorary Fellows of The Institute—viz., His Grace the Archbishop of Canterbury and His Eminence Cardinal Vaughan.

In presenting the balance-sheet for the year, the Council congratulate the Fellows and Members upon its highly satisfactory nature. It will be noticed that the mortgage on the office premises has been wholly discharged, and that a sum of £716 17s. 2d. has been carried to the accumulated fund, being the excess of income over expenditure for the year ending December 31, 1902, this fund now reaching £2,689 13s. 4d.

The expenses in connection with *The Journal of State Medicine* have been diminished, and the Council beg to acknowledge their continued indebtedness to Professor William R. Smith, who for the past three years has acted as the editor, in again refusing to accept the annual honorarium of £100 for his services.

The Council recommend that the Hon. Fellowship should be conferred upon the Right Hon. the Earl of Derby, K.G., and the Hon. Membership upon the Right Hon. the Lord Mayor of Liverpool and Mr. Morris Heyes, Hon. Auditor.

The Council, in presenting this satisfactory report to the Fellows and Members, beg to accord their most hearty thanks to the officers of The Institute for their unwearied services on its behalf, to which they feel the marked success of The Institute is in the main due, and they trust that they may still rely upon the continued co-operation of the Fellows and Members in promoting the usefulness and influence of a body which has done so much for the improvement of the public health of the country.

JAMES CANTLIE,
Hon. Secretary.

June 24, 1903.

THE ROYAL INSTITUTE OF PUBLIC HEALTH.

LIVERPOOL CONGRESS.

Wednesday, July 15, *to Tuesday, July* 21, 1903.

IN UNIVERSITY COLLEGE, LIVERPOOL.

Patron.

HIS MAJESTY KING EDWARD VII.

Vice-Patron.

H.R.H. THE PRINCE OF WALES, K.G.

President of the Congress.

THE RIGHT HON. THE EARL OF DERBY, K.G., G.C.B.

President of The Royal Institute.

PROFESSOR WILLIAM R. SMITH, M.D., D.SC., F.R.S.ED., J.P., etc.

Vice-President and Chairman of the Executive Committee.

THE RIGHT HON. THE LORD MAYOR OF LIVERPOOL (W. W. RUTHERFORD, ESQ., M.P.).

Vice-Presidents of the Congress.

The Right Hon. The Earl of Sefton.
The Right Rev. The Lord Bishop of Liverpool.
The Right Rev. The Lord Bishop of Chester.
The Right Rev. The Bishop of Crediton.
The Right Rev. Bishop Whiteside.
The Most Rev. The Chief Rabbi.
The Most Rev. The Greek Archimandrite.
The Right Hon. The Lord Mayor of Dublin.
The Right Hon. The Lord Provost of Edinburgh.
The Hon. The Lord Provost of Aberdeen.
The Hon. The Lord Provost of Glasgow.
The Right Worshipful The Mayor of Birkenhead.
The Right Worshipful The Mayor of Blackpool.
The Right Worshipful The Mayor of Bootle.
The Right Worshipful The Mayor of Chester.
The Right Worshipful The Mayor of Eastbourne.
The Right Worshipful The Mayor of Exeter.
The Right Worshipful The Mayor of Southport.
The Right Worshipful The Mayor of St. Helens.
The Right Worshipful The Mayor of Warrington.
The Chairman of the Cheshire County Council (Colonel George Dixon, J.P.).
The Chairman of the Lancashire County Council (the Right Hon. Sir J. T. Hibbert, K.C.B.).
The Chairman of the Mersey Docks and Harbour Board (Robert Gladstone, Esq.).
R. P. Houston, Esq., M.P.
Sir Elliot Lees, Bart., M.P., D.S.O.
W. F. Lawrence, Esq., M.P.

D. MacIver, Esq., M.P.
C. McArthur, Esq., M.P.
T. P. O'Connor, Esq., M.P.
Austin Taylor, Esq., M.P.
Sir J. A. Willox, M.P.
Colonel W. Hall Walker, M.P.
The President of the Consuls Association (J. O. Bunster, Esq., Chilian Consul-General).
The Vice-President of the Consuls Association (A. Denis de Trobriand, Esq., French Consul-General).
The Treasurer of the Consuls Association (E. Verspreeuwen, Esq., Belgian Consul).
The Hon. Secretary of the Consuls Association (B. A. Malandrinos, Esq., Greek Consul).
The Hon. James Boyle (American Consul).
Sir W. Mitchell Banks, M.D., F.R.C.S.
Sir John Brunner, Bart., M.P.
Sir Charles A. Cameron, C.B., M.D., F.R.C.P. Irel.
Sir W. B. Forwood, J.P.
Sir Michael Foster, K.C.B., M.P., M.D.
Sir Thomas Hughes, J.P.
Sir Alfred L. Jones, K.C.M.G., J.P.
Sir Henry D. Littlejohn, M.D., LL.D.
Sir Edward R. Russell.
Principal Dale, M.A.
J. Cameron, Esq., M.D., F.R.C.P.
W. Carter, Esq., M.D., F.R.C.P.
R. Caton, Esq., M.D., F.R.C.P.
Rushton Parker, Esq., M.B., F.R.C.S.
Alfred Holt, Esq.
W. H. Lever, Esq.
Rev. John Watson, M.A., D.D.
Alderman J. Ball.
Alderman W. J. Burgess.
J. S. Harmood Banner, Esq., C.C.
Alderman E. H. Cookson, J.P.
Alderman Thomas Clarke, M.D., J.P.
J. B. Colton, Esq., C.C.
R. A. Hampson, Esq., C.C., J.P.
Alderman M. Hyslop Maxwell, junr., J.P.
Alderman T. Menlove, J.P.
W. Oulton, Esq., C.C., J.P.
Alderman C. Petrie.
Alderman W. Roberts.
Alderman E. Walker, J.P.
Rev. T. W. M. Lund.

Hon. General Secretary.

E. W. Hope, M.D., Municipal Offices, Liverpool.

SECTIONS.

1.—Sanitation of Congested Areas and Rehousing the Dispossessed.

President.

Austin Taylor, Esq., M.P.

Vice-Presidents.

C. H. Tattersall, Esq., L.R.C.P.
James Niven, Esq., M.A., M.B.
R. S. Marsden, Esq., M.B., D.Sc.

Secretary.

F. T. Turton, Esq., Deputy Surveyor, Municipal Offices, Liverpool.

Address by Mr. Austin Taylor, M.P.

A discussion on the various methods employed in towns for dealing with Insanitary Areas will be taken part in by representatives of towns where these operations have been most active.

Papers:

"Methods of dealing with Unhealthy Areas," by Spottiswoode Cameron.

"Rehousing the Poor on the Outskirts of Large Cities," by Dr. James Niven.

Similar subject by Dr. R. Sydney Marsden.

"The Housing of the Dispossessed in Liverpool," by F. T. Turton, Esq.

2.—Preventive Medicine and Vital Statistics.

President.

J. Spottiswoode Cameron, Esq., M.D., B.Sc., Medical Officer of Health for Leeds.

Vice-Presidents.

Sir Charles A. Cameron, C.B., M.D.
Sir Michael Foster, M.D., M.P., F.R.S.
Sir Henry D. Littlejohn, M.D., LL.D.
A. K. Chalmers, Esq., M.D., D.P.H.
E. W. Hope, Esq., M.D., D.Sc.
E. Sergeant, Esq., M.R.C.S., L.R.C.P.
F. Vacher, Esq., F.R.C.S., M.R.C.P. Edin.
J. B. Russell, Esq., M.D., LL.D.

Secretaries.

A. A. Mussen, Esq., M.D., D.P.H., Municipal Offices, Liverpool.
H. S. Willson, Esq., M.B., King's College, London, W.C.

Papers:

"Preventive Measures against Tuberculosis in Large Towns," by Dr. N. Raw.

"The Supply of Humanized Sterilized Milk for Infants," by Dr. A. A. Mussen.

"The Transmissibility of Infectious Diseases during the Incubation Period," by Dr. H. S. Willson.

"Infectious Hospitals and 'Return' Cases," by Professor W. R. Simpson, M.D., F.R.C.P.

"Emergency Hospital Construction and Accommodation," by T. Shelmerdine, Esq., City Surveyor, Liverpool.

"Requirements in Regard to Underground Bakehouses," Paper by Dr. W. N. Barlow.

"Additional Powers required for the Effectual Control of Small-pox," by Dr. S. G. Moore.

Also a paper by Dr. Nash.

Special subjects for discussion:

"Underground Bakehouses." Speakers: Councillor J. Tousley J.P., Alderman Bowkett, and A. W. Last, Esq.

"Tubercular Disease among Domestic Cattle."

"Temporary Buildings for Consumptive Sanatoria."

"The Personal Hygiene of Consumptives."

"The Prevention of Small-Pox."

3.—Bacteriology and Comparative Pathology.

President.

Professor Rubert Boyce, M.B., F.R.S.

Vice-Presidents.

Professor G. Sims Woodhead, M.A., M.D., F.R.S.Edin.
Professor Sheridan Delépine, M.B.
S. Monckton Copeman, Esq., M.D, F.R.S.
R. S. Reynolds, Esq., M.R.C.V.S.

Secretaries.

Professor R. T. Hewlett, M.D., M.R.C.P., King's College, London.
H. E. Annett, Esq., M.D., D.P.H., University College, Liverpool.
T. Eaton Jones, Esq., M.R.C.V.S., Municipal Offices, Liverpool.

Papers:

"Bovine Tuberculosis and Public Health," by Professor J. McLauchlan Young, F.R.C.V.S., Marischal College, Aberdeen.

"The Standardization of Drugs," by R. Lord, Esq., M.D.

"The Milk Supply of Large Towns," by J. S. Lloyd, Esq., F.R.C.V.S., Sheffield.

"Are Animals Immune to the Effects of Drinking Contaminated Water?" by Henry Sumner, Esq., M.R.C.V.S., Liverpool.

"The Diseases of the Lower Animals Transmissible to Man, and their Various Forms."

"Has Locality an Influence on Recurrence after Operating for Malignant Disease?" by Professor D'Arcy Power.

Papers by Professor Rubert Boyce, F.R.S., and Dr. Ernest Glynn.

Subjects for discussion:

"Diseases of Animals conveyed by Milk."

"Tuberculosis in Cattle."

4.—Tropical Sanitation.

President.

Professor Nocht, M.D., Hamburg.

Vice-Presidents.

Major Ronald Ross, C.B., F.R.S.
Colonel Crombie, C.B.

Secretaries.

J. W. W. Stephens, Esq., M.D., D.P.H., University College, Liverpool.
James Cantlie, Esq., M.B., F.R.C.S., 46, Devonshire Street, London, W.

"Sanitation in West African Mining Camps," by Andreas Nell, Esq.

"A Plea for the Proper Medical Supervision of 'Refreshments' Purveyed on Indian Railways, and Convenient Lavatory, and Latrine Accommodation for the Travelling Indian Public," by Dr. H. D. McCulloch.

"The Anti-Mosquito Campaign in Sierra Leone," by Professor Ronald Ross, C.B., F.R.S.

"The Malaria Prophylaxis of Expeditionary Forces," by Dr. C. Christy.

"Tropical Sanitation on Ships," by Dr. Evans, of the Elder, Dempster Line.

"Beri-Beri."

And a paper by James Cantlie, Esq., M.B., F.R.C.S.

5.—Municipal Hygiene and Sanitary Legislation.

President.

Sir John Brunner, Bart., M.P.

Vice-Presidents.

Alderman T. Menlove, J.P.
Alderman W. J. Burgess, J.P.
Alderman J. Ball, J.P.
Alderman W. Roberts.
Alderman H. Campbell, J.P.
J. R. Grant, Esq., C.C.
A. Shelmerdine, Esq., C.C.
The Right Worshipful The Mayor of Fulham.
The Right Worshipful The Mayor of Holborn.
The Right Worshipful The Mayor of Southwark.

Secretaries.

E. W. Pierce, Esq., Deputy Town Clerk, Municipal Offices, Liverpool.
T. W. N. Barlow, L.R.C.P., D.P.H., Bootle.

Papers:

"Water-Supply," by Joseph Parry, Esq.

"Administration of the Vaccination Acts," by James Moulding, Esq.

"The Influence upon Public Health of the Present Method of Keeping Horses and Cattle in Towns," by T. Eaton Jones, Esq., M.R.C.V.S., Stafford Jackson, Esq., M.R.C.V.S., and others.

"Recent Sanitary Legislation," by E. W. Pierce, Esq.

"Necessary Sanitary Legislation," by Moresby White, Esq., Barrister-at-Law.

"The Application of Pneumatic Power to Works of Municipal Hygiene," by G. Maxwell Lawford, Esq., M.Inst.C.E.

"The Site Selected for the First Garden City," by Dr. F. E. Fremantle, County Medical Officer of Herts, and Guy's Hospital.

Subjects for discussion:

"The Steps to be taken by Local Authorities Relative to Tuberculosis."

"The Notification of Tuberculosis."

"Inspection of Cattle for the Purpose of Discovering Diseases likely to affect Milk."

"Sanitation of Cowsheds."

"The System of Sanitary Certificates and Sanitary Authorities."

"The Qualifications of Sanitary Inspectors."

"Necessary Vaccination Legislation."

"Necessity of Appointing a Medical Adviser to the Board of Education."

6.—Engineering.

President.

G. F. Deacon, Esq., M.I.C.E.

Vice-Presidents.

Professor Hele-Shaw, F.R.S.
T. H. Yabbicom, Esq., M.I.C.E.
Professor Wilberforce.
A. G. Lyster, Esq., M.I.C.E.
J. T. Wood, Esq., M.I.C.E.
H. P. Boulnois, Esq., M.I.C.E.
J. Parry, Esq., M.I.C.E.
A. B. Holmes, Esq., M.I.C.E.

Secretary.

J. A. Brodie, Esq., M.I.C.E., City Engineer, Municipal Offices, Liverpool.

Address by the President.

Papers:

"Sewage Effluence and the Construction of Filter-beds," by Professor Rubert Boyce, M.B., F.R.S.

"Traction on Road Surfaces," by Professor H. S. Hele-Shaw, LL.D., F.R.S., M.Inst.C.E.

"Mechanical Road Vehicles for Public Works," by T. Molyneux, Esq.

"Utilization of Destructor Products," by J. A. Brodie, Esq., M.Inst.C.E.

"Past and Present Modes of Collecting House Refuse," by F. W. Bowden, Esq., Assoc.M.Inst.C.E.

"Construction and Maintenance of Carriage Ways," by F. E. Cooper, Esq., Assoc.M.Inst.C.E.

"Road Construction and Maintenance," by Hector F. Gullan, Esq., Assoc.M.Inst.C.E.

7.—Child Study and School Health.

President.

Professor C. Sherrington, M.A., M.D., F.R.S.

Vice-Presidents.

Principal Dale, M.A.
Rev. W. J. Adams.
Rev. J. W. Bell-Cox.
Rev. R. M. Ainslie.
W. Oulton, Esq., C.C.
Edgar Browne, Esq., F.R.C.S.Edin.
Miss Elfrida Rathbone.

Secretary.

John Hay, Esq., M.D., M.R.C.P., 7, Rodney Street, Liverpool.

Papers:

"The Introduction of Military Drill into Schools," by Captain J. C. Robertson and Fred Andrews, Esq.

"The Physiology of the Kindergarten System," by A. B. Kingsford, Esq., D.P.H.

"Child Study: its Scope and Method in Education," by H. Holman, Esq., H.M.I.

"Dental Hygiene," by Norman Bennett, Esq., M.A.

"Speech Defects in Relation to the Mentally Deficient," by Henry Ashby, Esq., M.D., and Damer Harrison, Esq., F.R.C.S.

8.—Port Sanitary Administration.

President.

Alderman Thomas Clarke, M.D.

Vice-Presidents.

Alderman Barnett, Bristol.	Councillor Tutton, Swansea.
,, Fraser, Hull.	Alderman Giles, J.P., Liverpool.
,, Jacobs, Cardiff.	

Secretaries.

J. W. Mason, Esq., M.B., D.P.H., Town Hall, Hull.	W. Hanna, Esq., M.A., M.B., D.P.H., Port of Liverpool.

"Food Inspection," by Dr. Herbert Williams, Port of London.

"The Port Sanitary Authority and its Relation to Emigrants," by Alderman S. Cohen, Hull.

"A Plea for Community of Action among Port Sanitary Authorities," by Dr. A. M. N. Pringle.

"On the Question of Payment of Delegates' Expenses in Attending Conferences," by R. Sheriton Holmes, Esq., River Tyne.

9.—Ladies' Committee and Section of Domestic Sanitation.

President.

Mrs. Alfred Booth.

Vice-Presidents.

Mrs. Boulnois.	Lady Mitchell Banks.
Miss Bowring.	Lady Brunner.
Miss F. Calder.	Mrs. Dale.
The Lady Mayoress.	

And the members of the Ladies' Sanitary Association.

Secretaries.

Mrs. Topham Steele, 31, Princes Avenue.	Mrs. Yates, Ivanhoe Road, Liverpool.

"Elementary School Hygiene," by Mrs. H. Percy Boulnois, discussion to be opened by Miss Elfrida Rathbone and James G. Legge, Esq., Inspector of Reformatory Schools.

"Anti-Faddism," by Dr. Helen Boyle, discussion to be opened by Dr. Schofield and Dr. Stookes.

"Sterilized Milk," by Miss Heald, discussion to be opened by Dr. C. J. Macalister and Dr. F. Drew Harris.

"Care and Feeding of Infants," by Dr. Marion Hunter, discussion to be opened by Dr. Alice Ker, Dr. Nathan Raw, and Dr. Ashby.

"District Nursing," by Miss Amy Hughes, Superintendent of County Nursing Association, London. Discussion to be opened by Miss Sharples and Miss Wilson.

NOTE.—Intending readers of Papers who have not yet sent the titles of their Papers are requested to send them to the Secretary of the Section to which they wish the communication to be made.

PROVISIONAL DAILY PROGRAMME.

The Large Hall, at St. George's Hall, will be open from 9 a.m. daily, for the purpose of issuing tickets, etc. Letters for Congressists may be addressed to this Hall.

Meetings of the various sections will be held at University College.

The Athenæum News Room and Library (40, Church Street) and the Lyceum News Room and Library (corner of Bold Street and Ranelagh Street) will be open for the use of non-local Members of the Congress from July 15 to July 21, upon showing ticket of membership.

The Reading Room and Library of the Medical Institution, Hope Street, will be open for the use of medical members of the Congress.

WEDNESDAY, JULY 15.

9 a.m. to 4 p.m.—Reception-room open at St. George's Hall.

8 p.m.—Opening address by The Right Hon. the Earl of Derby, K.G., G.C.B.

Presentation of the Harben Medals for the years 1901 and 1902 to Sir Charles A. Cameron, C.B., M.D., F.R.C.P. Irel., and Professor William R. Smith, M.D., D.Sc., F.R.S.Edin.

(Delegates and members are requested to wear municipal or academic robes.)

THURSDAY, JULY 16.

9 a.m.—Reception-room opens at St. George's Hall.
10 a.m.—Opening meeting of the Preventive Medicine and Vital Statistics Section.
" " " Municipal Hygiene Section.
1 p.m.—Adjournment for luncheon.
2 p.m.—Resumed meeting of sections.
8.30 p.m.—Soirée at the Walker Art Gallery, William Brown Street. The guests will be received by Sir William and Lady Forwood.

FRIDAY, JULY 17.

9 a.m.—Reception-room opens at St. George's Hall.
10 a.m.—Opening meeting of the Domestic Sanitation Section.
" " " Engineering Section.
1 p.m.—Adjournment for luncheon.
2 p.m.—Resumed meeting of sections.
2 p.m.—Cruise on the Mersey in the ss. *Galatea* (by kind invitation of the Mersey Docks and Harbour Board), limited to fifty.
Visit to the ss. *Sobo* (West African steamer).
4 p.m.—Garden-party at Calderstones (by invitation of The Right Hon. The Lord Mayor of Liverpool).

SATURDAY, JULY 18.

9. a.m.—Reception-room opens at St. George's Hall.
Excursions to—

1. Chester and Eaton Park (limited to 120). (By kind invitation of the Duke of Westminster, visitors will have tea at Eaton Hall.)
2. Chester and Hawarden (limited to 120).
3. Isle of Man (limited to 200).
4. Rivington (limited to 50).
5. Northwich Salt Mines and the Delamere Forest Sanatoria (limited to 50).
6. Llandudno and Menai Straits (limited to 100).

SUNDAY, JULY 19.

Members of the Congress will assemble at the Town Hall at 10.30 a.m., and proceed to the Cathedral. The Lord Bishop of Liverpool will preach the sermon. Chains of office and academical or municipal robes will be worn.

MONDAY, JULY 20.

9 a.m.—Reception-room opens at St. George's Hall.
10 a.m.—Meetings of sections.

1 p.m.—Adjournment for luncheon.
2 p.m.—Resumed meeting of sections.
2 p.m.—Cruise on the Mersey (by kind invitation of the Birkenhead Corporation; limited to 100).
Excursion to Norton Water Tower, Runcorn Bridge, and Pathological Farm (limited to 40).
7 p.m.—Congress dinner. Tickets, 10s. 6d. each. Ladies invited.

TUESDAY, JULY 21.

9 a.m.—Reception-room opens at St. George's Hall.
9.30 p.m.—Annual Meeting of the Fellows and Members of The Royal Institute of Public Health in University College.
10 a.m.—Adjourned Meetings of sections.
Meeting of the Section of Tropical Medicine.
2 p.m.—Concluding General Meeting.

Each afternoon arrangements will be made for visiting municipal works connected with the sanitation of the city.

GENERAL ARRANGEMENTS.

The Sections will meet in University College, Liverpool.

The railway companies will issue return tickets to Liverpool at a fare and a quarter to members of the Congress. To obtain these special tickets a form, which will be sent by the Hon. Secretary, Municipal Offices, Liverpool, must be presented at the booking-office by those attending the Congress. These tickets will be available from the day before to the day after the Congress (July 14-22).

Daily tickets will be available on the Midland and Great Northern Railways, and periodical tickets will be issued by the Midland Railway. Cards of membership must be produced at the booking-office.

A special guide-book (with maps) has been prepared for delegates, and will be distributed in the reception-room.

A handbook for future reference, relating to municipal administration, etc., in Liverpool, will also be presented to each member of the Congress.

Badges for members of the Congress have been specially prepared, and can be obtained at the reception-room.

Members of the Congress are specially requested to acquaint the Honorary Secretary before July 6th with the excursions they desire to join, in order that the necessary arrangements may be made.

It is also requested that members desiring to visit Port Sunlight and members wishing to attend the Congress dinner will send their names to the Hon. General Secretary not later than July 10.

PUBLIC HEALTH MEDICAL APPOINTMENTS.

ROBERT BEATTIE, Esq., M.D., M.S., Q.U.I., Medical Officer of Health, Dewsbury.

JAMES ARTHUR HARGREAVES, Esq., M.B. Aberd., Medical Officer of Health, Wetherby, Yorks.

JOHN HENRY HARRIS, Esq., M.D. Durh., D.P.H. Camb., Medical Officer of Health, Dartmouth.

THOMAS ICK, M.B. Melbourne, Officer of Health, Peak Hill, West Australia.

JOHN ROBERTSON, M.D., B.Sc., Medical Officer of Health for Birmingham.

Professor ANTHONY ROCHE, M.R.C.P. Irel., Lecturer on Public Health at Maynooth College, etc.

DIPLOMAS IN PUBLIC HEALTH.

Trinity College, Dublin.—Part I.: William Francis Erskine, B.A., M.B., B.A.O.; James Henry Douglass, M.B., B.A.O.; Thomas William Gordon Kelly, M.A., M.D. Part II.: Thomas Gillman Moorhead, B.A., M.D.; George Raymond, M.B.; Walter Charles Oram, B.A., M.B.; Robert Tate, M.B.; Thomas William Gordon Kelly, M.A., M.D.; and Thomas Fletcher Telford, M.B., B.Ch., B.A.O.

REVIEWS, ETC.

"The Microscopical Examination of Foods and Drugs," by H. G. Greenish, F.I.C., F.L.S., Messrs. J. and A. Churchill, pp. 316, price 10s. 6d. This is an excellent work, well illustrated and up to date, and should prove of real value to the professional analyst in his daily work, as well as to the student, who has not only to pass examinations, but to well and truly lay the foundations of solid knowledge.

Rural water-supplies, by Dr. C. J. Russell McLean, price 1s., the author deals comprehensively with this important problem. A brochure which we can confidently recommend to the rural sanitarian, who, with small means, has to deal with administrative problems of serious importance to the country. The efforts to keep the population on the land are foredoomed to failure if they are not accompanied by measures to keep the rural population healthy, and we have excellent authority for holding that in this matter of water-supply many rural districts are lamentably deficient.

The annual report of the Medical Officer of Health for Blackpool is a modest record of much valuable work. Blackpool, perhaps owing to its popularity as a health resort, seems to have suffered from an epidemic of measles, but Dr. Coutts entertains the opinion that notification of the disease was of decided benefit to the town, as enabling the sanitary staff to come into contact with those in charge of the cases; and the experience of Blackpool undoubtedly points to the need of measures for controlling and systematically watching a disease which accounts for more deaths in England and Wales than scarlet fever, typhoid fever, typhus-fever, and small-pox combined. With Dr. Coutts' strenuous advocacy of the scientific treatment of sewage we are in complete accord, as there can be no doubt

that contaminated shellfish are only too often the causes of serious outbreaks of enteric fever. Arrangements have been made for the bacteriological examination by an expert, and Dr. Coutts points to a large saving of money which has thus been effected. In the matter of inspections of factories, buildings, of food and drugs, the sanitary staff has displayed great activity, and if the present high standard of zeal and intelligence is maintained the progress of Blackpool may be regarded as assured.

BOOKS, JOURNALS, REPORTS, ETC., RECEIVED.

THE following books, journals, reports, etc., have been received:

The Microscopical Examination of Foods and Drugs. H. G. Greenish, F.I.C., F.L.S.: J. and A. Churchill.

The Lancet; The British Medical Journal; The Sanitary Record; The Surveyor; The Medical Times and Hospital Gazette; The Medical Review; The Pharmaceutical Journal; The Councillor and Guardian; Albany Medical Annals; The Glasgow Medical Journal; Public Health; The Journal of Applied Microscopy; The Journal of the Society of Chemical Industry; Egésyég; Archiv für Hygiene; La Presse Médicale; La Salute Pubblica; The Journal of Tropical Medicine; The Caledonian Medical Journal; The Public Health Engineer; The Journal of the United Service Institution.

Annual Reports: Borough of Blackpool; Metropolitan Borough of Woolwich; Rhondda Urban District Council.

Rural Water-Supplies. By C. J. Russell McLean, M.D., D.P.H.

County Sanitary Administration in Essex. By J. C. Thresh, M.D., D.P.H.

Letters, Notes, Queries, etc.

Communications respecting Editorial matters should be addressed to "THE EDITOR, JOURNAL OF STATE MEDICINE, 19, Bloomsbury Square, W.C." *Those concerning business matters, non-delivery of the* JOURNAL, *etc., should be addressed to* "THE SECRETARY, The Royal Institute of Public Health, 19, Bloomsbury Square, W.C."

The agents for advertisements appearing in THE JOURNAL OF STATE MEDICINE are Messrs. Van Alexander and Co., 5, York Buildings, Adelphi, W.C., Telephone No. 1404, Holborn, to whom all communications with reference to advertisements should be addressed.

Communications which have been sent to other journals cannot be received.

Correspondents who wish notice to be taken of their communications should authenticate them with their names—of course not necessarily for publication.

Telephone number of The Royal Institute of Public Health, No. 1614 Central.

THE RIGHT HON. THE EARL OF DERBY, K.G.,
Honorary Fellow of The Royal Institute of Public Health,
President of the Liverpool Congress, 1903.

Photo by Messrs. Brown, Barnes and Bell, Liverpool.] [*Frontispiece*

The Journal of State Medicine.

THE OFFICIAL ORGAN OF
THE ROYAL INSTITUTE OF PUBLIC HEALTH.

VOL. XI.] AUGUST, 1903. [No. 8.

THE EARL OF DERBY, K.G.,

President of the Liverpool Congress, 1903.

THE Royal Institute of Public Health was singularly fortunate this year in obtaining as President of its Liverpool Congress The Right Hon. The Earl of Derby, K.G., G.C.B., A.D.C., LL.D. a nobleman who has had exceptional experience of public life. He was born in London, January 15, 1841, and was educated at Eton. After holding a commission for seven years in the Grenadier Guards, he entered the House of Commons, first as member for Preston, and subsequently for North Lancashire. He was successively a Lord of the Admiralty, Financial Secretary for War, Financial Secretary to the Treasury, Secretary of State for War, Secretary of State for the Colonies, and President of the Board of Trade. In recognition of his services he was raised to the peerage as Lord Stanley of Preston. He was then appointed Governor-General of Canada, which office he resigned in 1893, in which year he succeeded his brother as Earl of Derby. He was Lord Mayor of Liverpool in 1895-96, the duties of which office, it is generally admitted, he discharged with great assiduity, singular ability, and much dignity. With this wide official experience and practical acquaintance with the duties of a large municipality, it is not surprising that he has of late years shown an earnest desire to interest himself in many movements for the improvement of the health of the people. Two years since he was the President of the Organizing Council of the International Tuberculosis Congress in London, and it would have been impossible to have found a gentleman more qualified, from the points of view of experience, of sympathy with the objects of The Royal Institute, and of eminent personal qualities, to have accepted the office of President.

The Fellows and members are greatly indebted to his Lordship for accepting the office, which did so much to insure the marked success of the meeting.

ADDRESS TO THE LIVERPOOL CONGRESS

OF

THE ROYAL INSTITUTE OF PUBLIC HEALTH

BY

THE RIGHT HON. THE EARL OF DERBY, K.G.,
President of the Congress.

In the first place, will you allow me to express my very deep appreciation of the compliment which The Institute has paid me in asking me to preside over this great Congress? I feel it a high honour to be able to have my name recorded with those of men of such eminence and light in the medical and other professions as are indicated in the programme of the meeting as being associated with the active work of the Congress which we inaugurate to-night. I am called upon to address you on subjects of surpassing interest, but without technical qualification. I am appalled to observe the number of questions which might, in the course of such an address, be touched upon; their paramount importance, and the men distinguished in the medical and other professions who are to deal with them. Sanitation and the promotion of health are in the mouth of everyone. But I am not sure that we are not priding ourselves too much on the advance we have already made. I am not sure that on sanitary questions, after all, we are so much in advance of some nations of antiquity. It might be humiliating, but it is wholesome to remember that we were not the inventors of cleanliness or of the means by which health was kept and people made strong. If we looked no further than the Mosaic regulations we should find as complete a set of camp regulations for a large number of people moving about, and occasionally stationary, as great a care in details, as could be laid down by modern sanitary science. And if we looked to the people who had left the best record of themselves in this respect in their great work—the Romans—we should find that almost everywhere they took pains to place their cities in wholesome situations, to see that those cities had abundant water and wide streets, and that the constructive works equalled, if they did not surpass, the work of the town builder of modern times; and although there were evidences that the Roman contractor or workman was not above scamping when he got

underground, yet in skill and care his constructions contrasted well with that of the most enlightened municipalities of to-day. And as to personal cleanliness, it was hardly too much to suppose that the ceremonies in India, of which even yet we hardly realize the significance, arose from the daily duty of men associated with the influence of religion. The scrupulousness with which the Eastern would destroy anything in any degree contaminated, the rules of conduct prescribed by distinctions of caste, might be traced down to love of personal cleanliness and to care as to his food and its preparation, which points were observed without the least regard to personal inconvenience. Indeed, cleanliness seems to be one of the arts which has been revived, after a quiet rest during the Middle Ages, when soap and water were not at a premium, and when people, it was to be feared, did not change their clothes with modern regularity. Yet, again, I would say, we may doubt if we are not priding ourselves too much on what we have done, seeing that so much remains to be accomplished.

It was remarkable that the Eastern should have had an instructive knowledge of the contamination conveyed by insects and vermin. That insects might convey malaria appears to have occurred to a Roman writer on agriculture. If that allusion is rightly read, it is curious that an idea which has slept for so many hundreds of years should be brought to light once more by one closely connected with Liverpool—Major Ronald Ross, who, in reviving the idea, has carried it into practical application, and has brought about a sound state of sanitation in districts in West Africa and in Ismailia where before fever had been endemic. All this shows how much resulted from attention to small things. But in these days an increased duty is laid on us by the tendency of the population to congregate in the towns. I am not going to deplore that tendency. For my own part, I am contented that we live in a free country, and that the people are free to go where it seems to them best. The point is to provide better conditions for them wherever they are. Contrary to the general opinion, contrary to statistics, I am inclined to doubt the halo of healthiness which is thrown over the country. No doubt country life appears ideal, but if we follow it out in detail, in times gone

by we will find that life in the best country cottages was infinitely inferior to anything in the worst slums of the towns now. It is not the case — we know it painfully — that water is better in the country than in the towns, or even more abundant. Building regulations are doing much, and might do more, but there was a time when any hovel or hut sufficed for the peasant, though no better than the dwelling of the savage, and fulfilling no single condition of present-day sanitary requirements. In this question of town and country much could be said—at least, I think much could be said—on both sides: that where towns were bad, the country was far behind them. We find that even healthy districts, such as the north of Lancashire and Westmorland, were, in times past, constantly visited by the black fever—a sort of plague of great virulence—and an old local antiquary has assured me that, in the ancient parish registers on the borders, after these epidemics, there were recorded the deaths of a great many persons of the same name, and that the name then disappeared. But nowadays science stepped in, and skill and attention have stopped the recurrence of these dire visitations. At no time could we neglect imported diseases, and now we know that when plague was imported into this country its life, in face of the stringent measures taken to deal with it, was extremely short.

To my mind, the great redeeming point of the country is that there is light and air. These two attributes are of the most important assistance to the cause of sanitation. Old towns with narrow streets and alleys that excluded air had had their day. We now find that municipalities are conscious of their duties, and actuated by a desire to bring better conditions of health, light, life, and space into the towns they administer. I would mention with pride and great satisfaction the fact that you will see in Liverpool that the Corporation has been doing its duty well in this respect and in no half-hearted way. The Corporation's aim and object is to make the life of the people as conformable to the conditions of modern life as is possible. I believe that throughout England there has been a great awakening of municipal life in the direction of making the conditions of the people as favourable as possible to life and health. The questions of open spaces,

good drainage, and good water are of paramount importance. Other matters are the proper superintendence of the food that comes into the town, and the necessity of seeing that nothing unwholesome or deleterious is admitted. One other point is the milk-supply, and on this question, I think, much might be done by a good understanding between the farmers and the municipality. Corporations should not stretch their powers too far, and the farmers should not take advantage of any slackness, but should endeavour to acquaint themselves with the conditions under which milk should be delivered. I believe that it is in pure ignorance that the majority of the mistakes we have cause to lament under this head arise. Another important branch of health which deserves the closest attention is the conditions prevailing in tropical climates. It is appalling to think of the indifference displayed in the old days by the public in the sending of troops, for example, to the West Coast of Africa, and allowing them to swelter and die there on the seaboard. In those times many vessels were veritable pest-houses, and there were still to be seen countless graves on the banks of the St. Lawrence where emigrants had been landed only to die. Thanks to the progress of modern medical science, scurvy has now disappeared from shipboard, and all vessels are subject to a thorough inspection. Modern science must progress through an interchange of ideas and theories with Continental scientists. By such Congresses as this, broader rays of light will surely be thrown where darkness has hitherto reigned. All professions have their fancies and crochets, their rivalries and their difficulties, but surely those who follow the art of the prevention of disease are engaged in a duty which they perform with uniform and noble devotion, taking care not merely of the individual, but of the people as a whole. I would, in conclusion, heartily congratulate The Royal Institute of Public Health upon having chosen Liverpool for its meeting-place this year; for I am sure the noble work the Institute has done and is doing, and which has not only won for it the patronage of our Most Gracious King and His Royal Highness the Prince of Wales, but the approval and confidence of all interested or engaged in public health work, will be greatly stimulated by the many object-lessons which will be presented to its members and delegates in this great city.

OPENING ADDRESS
TO
THE SECTION OF BACTERIOLOGY
AND
COMPARATIVE PATHOLOGY.

BY
PROFESSOR RUBERT BOYCE, M.B., F.R.S.,
Professor of Pathology in The University of Liverpool,
President of the Section.

Scientific Progress and Prosperity.

I wish to draw your attention for a very few minutes to some lines of investigation in bacteriology and comparative pathology which have materially aided our commerce and the general prosperity of the nation.

It is fitting that in a city like Liverpool, when a new University has been created, no pains should be spared to make the University not only the best equipped of its kind, but also that its great departments should be so organized that they can be readily used by the City Corporation, by district authorities, by the Chamber of Commerce, and by commercial firms seeking advice.

We want, on our part, the advances which we make in science to be used to the full advantage by the community, and it is our duty often to point out how that can be done. In return we require the active support of the community. In Liverpool, as you are all aware, this interdependence has been fully recognised. The most striking example of the direct benefit of medical research to the progress of mankind was Jenner's discovery of vaccination, and the nation very rightly showed, through its Parliament, the appreciation of his work by a vote of thanks and monetary grant. Time only confirmed the wisdom of that action. With the advent of Pasteur the importance of the study of bacteriology to mankind was completely demonstrated. Everything the great man did had its practical bearing. The wine-grower and brewer throughout the world will for ever owe to him a great debt of gratitude. He put new life into the silk manufacturers; he was of immense service to the farmer: he came to their rescue and brought prosperity to them. The leaders of

the various industries who benefited by Pasteur were very thankful to him when the benefits were fresh in their minds, but their descendants have often forgot their obligations. It is true that a splendid Pasteur Institute has been placed in Paris, that a great brewer has given to London a Lister Institute; but what have the great brewers done for the science which made them in the great provincial towns of this country? We now appeal to their sense of gratitude and generosity. Great as were Pasteur's benefits to commerce direct, they were small compared to the service he rendered humanity at large. He demonstrated the nature of those diseases which paralyzed communities and commerce. He showed the rôle parasites played in their causation and mode of spreading, and he clearly proved how these diseases might be prevented and cured.

Owing to Pasteur's brilliant and useful work, parasitology has been firmly established, and forms one of the most attractive sciences of to-day. Lord Lister adapted his reasoning to the treatment of wounds, and, like Jenner, has earned the gratitude of the country. The manufacturer daily makes use of the principles of sterilization, and a large canning industry has sprung up. Wherever there is a medical laboratory Pasteur's work is carried on, and every year sees the birth of some new fact in preventive medicine of importance to the welfare of mankind.

If we analyze more closely how our work touches the community in which we live, we first of all come in contact with the relationship of bacteriology to the Health Department of a great city. No city is equipped that has not its Bacteriological Department. The Chief Officer of Health must know very precisely whether a case is one of plague or cholera or not; whether the dog which has been suffering from a fit and from some obscure symptoms is affected with rabies or not. It is necessary to know whether the food and the water consumed by the people is free from deleterious bacteria. There are, in addition, a large number of problems affecting the health of the community and the prosperity of the city which demand a careful bacteriological investigation. How is typhoid spread? What carries the virus of small-pox? What is the cause of measles, of epidemic diarrhœa? In other words, there exists, in addition to routine

checking work, a whole field of research in which the community is directly interested, and to the support of which it is asked to directly contribute.

The relationship of bacteriology to the engineer has now had ample demonstration. The water engineer has to recognise that his worst enemy is a pathogenic organism. The gathering-grounds, his reservoirs, and his filters have all to be calculated from this amongst other points of view. He now thoroughly recognises the significance of the colon bacillus. It is not only pathogenic bacteria, however, which trouble the water engineer. His filter cloggs, his water turns dark in colour, and the calibre of his great water-mains is much diminished. Bacteria in some form or another have led to this condition of things, and investigations are imperative.

The city engineer has now to construct apparatus and tanks and beds with the object of encouraging the growth of bacteria, because now we have learnt to utilize this force for the destruction of organic matter. The engineer encourages the growth of the harmless bacteria, and he tries to bring about the destruction of the harmful ones. The significance of bacteriology requires to be understood by the municipal engineer, and a wide field of investigation lies open to us. River and sea pollution are subjects upon which we can throw much light. How is the self-purification of streams and estuaries brought about? What is the distribution of the colon bacillus in rivers and in seas? These are questions which affect the river conservators and the fishing industries. River fish are becoming scarcer on the one hand, and on the other hand the oyster merchant is realizing the significance of the colon bacillus. I hardly think that there exists an oyster merchant in this country who does not realize the importance of freeing the beds of this pest. What a very remarkable step forward this indicates! It all tends to impress upon the community the absolute necessity of supporting and keeping in touch with scientific progress. The prosperity of a community depends upon its health, and it falls largely on our province to show how this can be done. This fact shows the way to numerous investigations in the prevention of zymotic diseases, in the department of immunity, and in the study and prevention of cancer and many

other diseases. It is splendid to see how citizens are coming more and more to our aid over these questions, and endowing cancer amongst other researches. If we had more money we could do a vast deal more work; seeing that capable workers are numerous, and that the amount of money required for helping these men is relatively small, it is a pity that this opportunity for doing good is not seized.

Business men have seen the advantage to be gained by encouraging investigations. One of the most striking examples of this is shown in the support that our own and other tropical schools of medicine have received. Not without reason, for, thanks to my colleague, Professor Ross, a revolution is being worked in the health of the tropics. Letters testifying to the success of the preventive measures reach us from all quarters, and thus the practical application of a most minute and abstruse research into the mosquito has convinced the merchant that we are worthy of support. Their support not only enables us to carry out much practical routine work, but it places the whole field of tropical diseases before us for research.

In the domain of comparative pathology, perhaps more than in the case of human pathology, the subject of parasitology has obtained an extensive recognition. It ought to be so. The diseases to be feared in the lower animals are those which are spread from animal to animal, and decimate hundreds and thousands. A parasite in some form is the cause; it is necessary to work out its life-history, to find out how it causes the disease, where it lurks outside the body, and how it may be killed. In animal diseases a wide field for investigation remains to be attacked—it is unturned-over soil. We are too prone to regard the loss of hundreds and thousands of animals as inevitable. Panics arise when the words "foot-and-mouth" disease are breathed, and all this is due to our ignorance. There is no field of research which would repay the student, the farmer, the cattle importer, and this country so much as the investigation of animal diseases. What attempt has been made in this country to tackle these problems? An exceedingly small amount. Gentlemen, we are met together to encourage one another, and to demonstrate the usefulness of the work which we make a life-study.

PRESIDENTIAL ADDRESS
TO
THE SECTION OF PREVENTIVE MEDICINE
AND
VITAL STATISTICS.

BY
J. SPOTTISWOODE CAMERON, Esq., M.D., B.Sc.,
Medical Officer of Health for the City of Leeds.

It is a little interesting to mark progress from time to time by looking back to a definite period. Such a period is furnished to me by the circumstance that in the year 1895 I presided over the same section of this Institute at Hull. My address was then largely directed to the desirability of systematic house-to-house inspection, a matter as to the importance of which health officers were mostly agreed, but which was looked upon then (and, I fear, is occasionally looked upon still by sanitary authorities) as not contained in the articles of war.

Although the number of sections in the Conference for this year has grown from four at the Hull meeting to no fewer than nine at Liverpool, this is not because preventive medicine takes a less important position in regard to sanitation than formerly, but because the subject of the Section itself was growing so big that it was necessary to particularize the different branches of preventive medicine in order to allow the work to be at all properly conducted in reasonable time. "The Hygiene of School Life," "The Administration of Poor Law Authorities," "Domestic Sanitation," "Tropical Sanitation," and "The Sanitation of Unhealthy Areas," are all offshoots of the subject of "Preventive Medicine," of which also, strictly speaking, "Municipal Hygiene" and "Comparative Pathology" are outposts. The change which has come over the subject reminds one of the changes and specializations in our medical schools. There was a time in some medical schools when there were two chairs, one of medicine and one of surgery. Both the physician and the surgeon required naturally that the subject of anatomy should be taught, and a chair was accordingly added, not infrequently, however, occupied, even quite recently, by some eminent practising surgeon. What we call in the North "the institutes of medicine" and the materia medica chairs naturally followed. But the work of these professors has in more recent times been split up again, and histology as taught by the

physiologist, and histology as taught by the pathologist, have been made separate subjects. Materia medica has been separated into botany, chemistry, pharmacology, and therapeutics; physiological and pathological chemistry have been separated. It is, therefore, not unnatural that the parent section of preventive medicine at these conferences should have given rise to the various other sections. We rejoice that their success has made this subdivision necessary.

To return for a moment to the subject of my address in Hull on the Systematic Sanitary Examination of Houses. The opinion is gradually gaining ground that the inspection, which is a duty laid upon the local authority by Section 92 of the Public Health Act of 1875, can be better carried out by a systematic examination of the district rather than by waiting in the office until someone reports a nuisance, and then going to see if there really be one. This Section 92 of the 1875 Act, as has been pointed out elsewhere,* was not even then new, but had found place in the statute-book as early as the Sanitary Act of 1866.

Not only are the authorities themselves more willing now than eight years ago to carry out the systematic inspection, but the public regard the visit of the inspector as a personal advantage rather than a trouble. When this matter came up for discussion before the Sanitary Committee in Leeds in connection with the appointment of additional inspectors, and when it was opposed by some of the property owners, one of our aldermen narrated his own experience. He told the Committee that, a few years before, the Ward Inspector had come to his house in the ordinary way, as part of the house-to-house examination of the district, and had suggested putting a test down his drains. The alderman told him that he thought it was quite unnecessary, as his drains had been looked at only a short time before, and he believed they were in perfect order. The inspector courteously pressed the matter, saying that he was going everywhere, and that he did not wish to be refused by a member of the Council, and was permitted to make the examination, which, to the surprise of the alderman, revealed unexpected defects in the drainage, which were, of course, remedied; but the circumstance so impressed him that he became a strong advocate for the systematic inspection of dwellings.

* Presidential Address to the Society of Medical Officers of Health, October, 1902. *Public Health*, November, 1902, reprinted.

The same alderman has several times, in a humorous way, pointed out the advantage of having an outbreak of infectious disease in a neighbourhood. He has spoken something in this way: "When a case of scarlet fever occurs in the yard, it is a great advantage to the other inhabitants. The Medical Officer sends the hose-pipe down and flushes all the drains, has a special clearing out of all the ashpits, has the house thoroughly cleaned down, and the yard is cleaner, sweeter, and healthier than it had been for months before." I need not say that all Medical Officers of Health would only be too glad to extend these amenities to all yards and all courts at short intervals, if the Authority were only willing to bear the expense.

Nature last year made a valuable experiment of this kind for us by giving us a cool and wet summer. Holiday-makers grumbled, but the infantile mortality of the third quarter, especially in the large towns, fell enormously. In the whole country "the mortality of infants, measured by the proportion of deaths under one year of age to registered births, was 125 per 1,000, the average in the ten preceding third quarters having been 197.* Compared with the mean rates in the ten preceding third quarters, the mortality of infants under one year of age showed a decrease of 36·5 per cent., that of persons between one year and sixty years of age a decrease of 12·2 per cent., and that of persons aged sixty years and upwards a decrease of 3·4 per cent."†

In England and Wales the mortality from diarrhœa during that quarter was equal to one of 0·79 annually per 1,000 of the population at all ages, "which is below the corrected average rate in the corresponding quarters of the previous ten years by not less than 1·52 per 1,000."‡ While in the whole of England the diarrhœa death-rate in the third quarter of 1902 was 0·8, as against 2·3 in the same quarter of the ten years, in some towns the fall was even more marked in amount, if not in proportion. West Ham, with an average diarrhœa mortality in the third quarter of 4·1, had one of 1·8 last year; Brighton, with a diarrhœa mortality — 2·8 — only slightly above that of the country at large during the ten years, had a mortality of 0·7 below that of the country during 1902; Leicester, with an average

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* Registrar-General's Report for the third quarter, 1902.

† *Op. cit.*, p. v. ‡ *Op. cit.*, p. vi.

diarrhœa mortality of 5·1 in the ten years, had a rate of only 0·9; Hull, with an average of 5·5, had a rate of only 0·8; whilst towns like Huddersfield and Halifax, whose average mortality had been only 1·7 and 1·1, had rates of only 0·4 and 0·2. Why should we not be able, with a hose-pipe and a cleansing yard and a sterilized milk depot, to do something to lessen the tremendous mortality amongst children which takes place every autumn?

To refer again to the address already mentioned, in comparing the twenty-five years since the Public Health Act of 1875 came into force with the twenty-five which immediately preceded them, I found, from figures brought up to date for me by my friend Dr. Tatham, that the improvement in our death-rate in this country was one of more than 14 per cent. Not only so, but every successive quinquennium during the second period of twenty-five years—the period since the 1875 Act—had a lower rate than that which preceded it. These favourable results, however, did not obtain in regard to infantile mortality. The average mortality from 1851 to 1875 was 154 per 1,000 births, and only in one period of five years was it so low as 151. During the second period, from 1876 to 1900, the average was 147, and in only one of the quinquennial periods did it exceed 151. The improvement, great as it was, however, was rather less than 5 per cent., as against an improvement of 14 per cent. at all ages. Evidently much yet requires to be done to save this unnecessary waste of infantile life.

This is one of the subjects which, in connection with the interesting experiment which is being carried on at St. Helens, at Battersea, and—most important of all to us—in Liverpool, will come up for discussion on Dr. Mussen's paper in this Section. Other subjects which are set down for discussion deal with the prevention of tubercle in large towns and amongst domestic cattle, and with the questions of sanatoria and the personal hygiene of consumptives. The small-pox outbreak, which is apparently—at any rate, for a time—abating in its violence, will also suggest a subject for discussion; while other papers have been put down upon the relationship of infectious hospitals to return cases and the erection of emergency hospitals, and that important subject at the present time for all Medical Officers of Health and Sanitary Authorities, the requirements for underground bakehouses.

INTRODUCTORY ADDRESS

TO

THE SECTION

ON

PORT SANITARY ADMINISTRATION.

BY

ALDERMAN THOMAS CLARKE, M.D., J.P.,
Chairman of the Liverpool Port Sanitary Committee,
President of the Section.

It was right and proper that, when The Royal Institute of Public Health consented to hold its Annual Meeting in Liverpool, those upon whom devolved the making of the necessary detailed arrangements should decide to have a section devoted to the consideration of matters relating to port sanitary administration. Liverpool has long occupied a foremost position amongst the ports of the world; perhaps no other is so well known to the average foreigner. Her ships sail to all ports. She has been a pioneer in opening up little-known countries and bringing their productions here for distribution. Last year the tonnage entering and leaving the Mersey amounted to the colossal total of 29,000,000 tons, ships by thousands, and the income of the Mersey Docks and Harbour Board to £1,500,000. The value of the exports amounted to £106,000,000—nearly a third of the total exports of the United Kingdom—and the imports to £132,000,000, more than one-fourth of the total imports of the whole country. Last year there sailed from the port no less than 214,000 emigrants, and probably at least 100,000 landed here. Liverpool is almost absolutely dependent for its prosperity—nay, for its very existence—upon its shipping. It has comparatively few other industries, and does not even build its own ships. You will therefore see from these facts what a keen interest Liverpool must take in port sanitary affairs, and how essential it is that the administration of these affairs should be conducted with tact, judgment, and unceasing watchfulness.

The Port Sanitary Authority of Liverpool, as at present consti-

tuted, was brought into being by an order of the Local Government Board dated October 31, 1893. Prior to that date the sanitary control of the port was variously subdivided amongst the riparian authorities interested, the Board of Trade, and the Customs, under the Quarantine Acts. No doubt at that time the great bulk of the work fell upon Liverpool, but it has, as a matter of fact, delegated certain powers which it possessed to the other riparian authorities. In December, 1892, the necessity for concentrating the control was forced into prominence by the approach of cholera, and it was obvious that the existing system, such as it was, had many weak points. An inquiry was held by the Local Government Board, and although one of the riparian authorities desired strongly to have a joint Board, it was ultimately decided that the City Council of Liverpool should have full authority, the other bodies abutting on the river contributing a fixed percentage of the annual cost, but without any representation. It is worthy of notice, in view of recent events, that Bootle as well as Birkenhead objected to the formation of a joint Board, and desired that the matter should be left entirely with Liverpool. The duties of the Port Sanitary Authority may be included under two distinct heads: First, the sanitation of vessels themselves in the interests of passengers and crews. The Local Authority has not undivided and full control in matters affecting sanitation of vessels, as the provisions of the Merchant Shipping Act and Passenger Act relate partly to matters of hygiene, and were in operation before the era of port sanitation, and are not always in accordance with the more enlightened ideas of the present day.

The Liverpool Port Sanitary District is divided, for the purposes of inspection of vessels, into three divisions, to each of which an inspector is appointed. Two additional inspectors have been appointed for tidal purposes. The points to which these inspectors are required to pay special attention include: The efficiency of sanitary fittings and the condition of the bilges and bilge-water; the source of supply and storage of drinking-water; cleanliness; accessibility for cleansing purposes and protection of tanks, etc., from contamination; and the condition of crews' quarters with regard to ventilation, cleanliness, and pro-

tection from weather. Interesting and important, however, as this question of the sanitary well-being of those domiciled on board ship is, it must be admitted that the aspect of port sanitary work which has forced itself most prominently into public view is the second—that of checking and preventing the introduction of sea-borne cases of infectious disease. The nation, as a whole, has during the last few years become fully alive to the importance of this work, as constituting the first line of defence against cholera, plague, and yellow fever; and the sanitary authorities and their officers are satisfied that, on the whole, the powers vested in them under the Local Government Board's regulations, 1896, are ample and sufficient to deal with these diseases.

By an agreement with the Mersey Docks and Harbour Board, which controls the docks on both sides of the river (Garston Docks excepted), no vessel coming from an infected port will be allowed by the Board to enter one of their docks until a medical certificate has been handed to the Captain showing that the vessel is free from infection. A list of infected ports is handed to the Board by the Port Sanitary Authority. The Dock Board by this action show their confidence in the Port Sanitary Authority, and are ever ready to listen to and act upon the reasonable representations of that body.

The Liverpool Steamship Owners Association, who own one-fifth of the whole British Steamship tonnage, have expressed their confidence in the Port Sanitary Authority regarding its action when threatened with plague; the Secretary wrote that the Association had instructed him to thank the Port Sanitary and Hospitals Committee for the steps they had taken with such complete success to keep the port free from the outbreak from which Glasgow was suffering, and to express the earnest hope that none of those precautions would be relaxed. As proved above, the Port Sanitary Authority work in perfect harmony with the two powerful bodies mentioned, but there is also a third body of great consequence—the Consular Body, representing about forty different foreign States. We have hitherto succeeded in securing and retaining the confidence of these gentlemen, not only by the success of our measures for protecting the city and port and by

the reasonable and scientific nature of the precautions adopted, but also by giving them the earliest and fullest information upon all points upon which they had a right to be informed.

With regard to cholera, plague, and yellow fever, it is important to state that ships bound to the Port of Manchester are brought up within the Port of Liverpool, and in the event of any vessel being found infected, or suspected to be infected, with either of those diseases, the vessel is placed under the control of the Liverpool Port Sanitary Authority; and if, after having entered the Port of Manchester, the Medical Officer of Health of that port should find a ship to be infected, and if she has not yet docked, he is required forthwith to notify the Medical Officer of Health of the Port of Liverpool of the case, and to remain on board the ship until it has been brought back into Liverpool quarantine station, or until the arrival of the Medical Officer of Health of Liverpool, who will take charge of the vessel.

The ordinary infectious diseases found on board ship are dealt with in precisely the same manner as a case of infectious disease in a private house, and requiring removal to the hospital, would be dealt with. Disinfection, etc., follow in the usual routine. Copies of the regulations relating to the forms of disease are printed in various languages and distributed amongst shipowners, consuls, captains, and all interested. But there is one important exception to this simplicity of routine, and that is small-pox. This disease prevails all over the world, and the probability of small-pox infection being introduced into any British port is very much greater than that plague, cholera, or yellow fever should be so introduced, and those best qualified to judge agree that small-pox, being introduced, is far more likely to obtain a footing in an ordinary British community than any of the other diseases mentioned, and yet our powers of dealing with this disease as Port Sanitary Authority are very limited and quite insufficient.

Unless cholera, plague, or yellow fever is existent on board a vessel there is no legal authority for detaining her on sanitary grounds, but I strongly feel that the power of limited detention ought to be legalized in the case of small-pox. Eighteen months ago a deputation from the Liverpool Port Sanitary Authority had

an interview with the Local Government Board, and laid down the following propositions:

(*a*) That if in the opinion of the Port Medical Officer a vessel arriving in the port is dangerously infected with small-pox, he should have power to cause the detention of such vessel for a reasonable period not exceeding thirty-six hours, so that sanitary measures can be thoroughly carried out.

(*b*) To make the Port Sanitary Authority and their medical officer the vaccination authority and the vaccination officer respectively for port sanitary districts, and to give powers of vaccination and revaccination.

(*c*) To give power to deal with contacts by isolation, etc.

(*d*) To give power to impose a penalty for withholding or giving false information as to names and addresses.

Some have advocated the inclusion of small-pox in the cholera, plague, and yellow fever order; but as small-pox is an indigenous disease, and always, or nearly always, present with us, such inclusion would be very inadvisable, and would furnish foreigners with a weapon which might be frequently used to the detriment of our shipping interests, and I think that the course suggested by Liverpool, and approved by the Port Sanitary Association, is the proper and safer one, and sufficient to meet the requirements of the case. Although eighteen months have passed away since we approached the Local Government Board, yet not a scrap of information has reached us either verbally or in writing as to the Board's intention in the matter. The Board may be a safe and judicious guide, but it is certainly slow and dilatory. I hope this Section will adopt a strong resolution on the subject of imported small-pox, and that the Council of The Institute will use their influence in the matter.

It is only fair to say that, while our local powers are defective, those connected with shipping give every facility and render every assistance in carrying out sanitary measures. All ships infected with small-pox were, after removal of the patients, thoroughly fumigated, and, where necessary, the vessel was detained in the river until disinfected. As a rule, everyone on board was revaccinated, and much assistance was afforded by

the example and help of the officers on board these ships. During 1902 twelve vessels arrived in the Mersey with small-pox. Ships arriving in the Mersey and requiring inspection are, as a rule, dealt with during a period of four hours each tide—two hours before high water and two hours after; but, as a matter of convenience, vessels arriving after the tides are dealt with as soon after arrival as possible.

The Port Sanitary Authority retain the services of two Assistant Port Medical Officers, who are continually engaged in the tidal inspection of ships, taking tides alternately. Their work has been carried out in connection with the officers of the Customs, who are the first to receive intimation of sickness on board any vessel approaching the port, either by telegraph from Point Lynas, or Moville, or Queenstown, or by speaking with vessels entering the river, and who, in addition to two launches in constant use for their purposes, have their staff so arranged as to intercept at the entrance to the docks such vessels as they have not been able to board in the river. The Customs Depot of the port and the port sanitary offices are within a few yards of one another, and all information with regard to the health of vessels is immediately reported from the former to the latter. Every facility is at all times given by the collector of Customs to enable the medical officers to accompany the Customs officers on board the Customs launches, and valuable assistance and co-operation are afforded, as these launches are employed to visit vessels at every tide; and the Port Sanitary Authority have also provided that if at any time, through stress of weather or temporary repairs of launches, the Customs launch is not immediately available when required for urgent or special work, a tug shall be used. A tug can be hailed at the landing-stage as readily as a cab at a cab-stand. The entire ambulance and disinfecting staff of the city are at the disposal of the Port Sanitary Authority.

Vessels having serious infectious disease on board, or in an infected condition, are sent to the appointed quarantine ground, which lies some two miles up the river, and opposite to this is situated the Port Sanitary Hospital, on the Cheshire side of the river. This hospital is well isolated, is close to the river Mersey,

and contains fifty beds. During last year it was extended by the erection of a new pavilion, by providing suitable accommodation for the staff and for administration, by modernizing the older part, and by the erection of a laundry and disinfecting apparatus. It is now a complete and independent hospital. As a rule, the city hospitals are used for the reception of all sea-borne cases of infectious diseases, excepting those dealt with under the Local Government Board Order of 1896, which are removed to the Port Sanitary Hospital. This is the more convenient course to adopt than to send all sea-borne cases to the Port Sanitary Hospital. Those who are required to be removed to that hospital are conveyed by tug or ship's boat to the hospital jetty, and there landed. The majority of the cases are treated in the city infectious diseases hospitals, as I have said, and are removed from the dock after the vessel has been berthed. Infected clothing is either destroyed on board the vessel or removed in carbolized sheets, to be disinfected at one of the city disinfecting establishments.

We have not forgotten our friends the ingenious and wide-awake rats. Various schemes in the nature of obstructions have been devised and carried out to keep the rat on board his own ship, but experience has taught us that these devices cannot be entirely relied upon. We have now resorted to trapping, and this can only be carried out effectively by an experienced and reliable rat-catcher. The rats killed on board are destroyed in the ship's fires; those taken alive are sent to the Corporation bacteriologist. Of course, the action of the rat-catcher is confined to ships arriving from plague-infected ports, although careful inquiries are made and precautions taken as to rats on board ships arriving from ports that were formerly infected.

I have omitted to mention that the five inspectors work under he supervision and carry out the instructions of the Assistant Port Medical Officers, and that one of them attends each inspection of emigrants, and takes charge of any rejected cases of infectious sickness.

Now, gentlemen, I feel that I must bring my somewhat tame and disjointed remarks to a close. Of course, every man in his

own sphere of work thinks that work to be of great importance, but I venture to say that it would not be possible for us to over-estimate or exaggerate the importance of the work of a Port Sanitary Authority, more especially in a place like Liverpool. At times not only the health of the port, but its trade and commerce and the health of the whole country, are in the keeping of the Port Sanitary Authority, and these can only be effectively safeguarded by unceasing vigilance and skill on the part of the Authority's officers, more especially its medical officers.

"In times of peace prepare for war." There must be an ample reserve of hospital accommodation, and not for one form of disease only. To meet the uncertainties and fluctuations of port sanitary exigencies, the Authority itself must not be dominated by ideas of economy only, but by a broad and enlightened appreciation of their responsibilities.

There must be a persistent effort made to work in harmony and co-operation with all those who can in any way hinder or help you in the discharge of your important duties.

"Measures, not men," used to be a political party cry. I attach the greatest possible value to the men. Whatever is best administered is best.

ARMS OF THE CITY OF LIVERPOOL.

The Arms of Liverpool (which had been used by the Corporation for many years previously) were confirmed by the authorities of the College of Arms on March 22, 1797. The following is the heraldic description:

> "Argent a cormorant, in the beak a branch of seaweed, called Laver, all proper; and for the Crest, on a wreath of the colours, a cormorant, the wings elevated, in the beak a branch of Laver proper."

Supporters were granted on March 23, 1797. The following is their heraldic description:

> "The dexter, Neptune, with his sea-green mantle flowing, the waist wreathed with Laver, on his head an Eastern crown or, in the right hand his trident sable, the left supporting a banner of the arms of Liverpool; on the sinister, a Triton wreathed as the dexter, and blowing his shell, the right hand supporting a banner thereof, a ship under sail in perspective, all proper, the banner staves or."

TUBERCULAR EXPECTORATION IN PUBLIC THOROUGHFARES.

BY

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Demonstrator of Tropical Pathology in The University of Liverpool.

No greater stimulus could have been given to a renewed and more careful study of the etiology of tuberculosis of man and animals than the astounding assertions made by Professor Robert Koch at the Meeting of the British Congress on Tuberculosis in London on July 22, 1901. Whether his chief statements be right or wrong, it is certain that his important announcements revived the interest of bacteriologists and hygienists, and gave a greater stimulus to investigations into the methods by which tuberculosis could be prevented and combated.

Particular attention is naturally directed to investigations into the methods by which infection may be brought about by human tubercular sputum, and to the measures which may be employed to prevent such infection; for all observers agree with Koch that human sputum is the main source of human tuberculosis:

"As to the question where the inhaled tubercle bacilli come from there is no doubt: certainly they get into the air with the sputum of consumptive patients. By coughing, and even speaking, sputum containing bacilli is flung into the air in small drops, and can at once infect persons who happen to be near the cougher. But it may also be pulverized, when dried, in the linen or on the floor, and get into the air in the form of dust."

Although it is certain that the sputum expectorated by tubercular individuals is most commonly a very dangerous source of infection in the overcrowded and ill-ventilated dwellings, workshops, and other rooms occupied by the lower classes; still, there can be but little doubt that infection may arise from the inhalation of dust particles in our public thoroughfares and streets, and that this will continue a source of public danger until an efficient means of prevention can be inaugurated.

Professor Brouardel, at the same Congress, characterized the

custom "of expectorating on the ground as a disgusting and dangerous habit," and stated "that once the habit has disappeared, tuberculosis will decrease rapidly."

Tubercle bacilli in sputum expectorated on the street walks are influenced there by two physical agencies—desiccation and the action of light—and also are submitted to any influence which may be exerted by putrefactive and other organisms in the sputum or gaining access to it. It is well known that tubercle bacilli resist the action of such organisms for a long period, and, in general, the expectorated mass has become a powdered dust before their action is likely to exert any deleterious effect on the tubercle bacilli.

The action of desiccation alone has been known for many years. Schill and Fischer showed that tubercle bacilli in sputum, dried in a thin layer, retained their virulence for six months; while Sormani showed that sputum dried in a thin layer on glass was not virulent after four months. Cornet believes that, considering that tubercle bacilli may continue virulent in the dust of dried sputum for at least three or four months, in the country, where the dust is diluted by a large volume of air, the chance of infection thereby is but small; but in large towns, particularly in the most frequented streets, in summer or during continued dry weather, the infecting material becomes more abundant, and there is danger of infection with the tubercle bacilli in street dust.

Experiments by Nuttall seem to indicate that, under favourable temperature circumstances, tubercle bacilli may even multiply in tubercular sputum outside the body.

There now remains to be considered only the action of light on the tubercle bacilli in sputum expectorated on to the street sidewalks. Koch states that "he was able to determine that tubercle bacilli, according to the thickness of the layer in which they were exposed to sunlight, were killed in a few minutes to some hours. Also that diffuse daylight had a similar effect; cultures of tubercle bacilli die if they are exposed close to the window for five to seven days."

Feltz asserted that pulverized tubercular sputum exposed to

sunlight was virulent after 140 days. Migneco, as the result of a number of experiments, makes the following conclusions:

1. That sunlight has an injurious effect on *Bacillus tuberculosis*, as upon other organisms.

2. That tubercle bacilli contained in sputum on soiled linen and woollen stuffs do not withstand the action of sunlight for as long a period as twenty-four to thirty hours—if the layer of sputum be not too thick.

3. The virulence of the tubercle bacilli gradually diminishes after ten to fifteen hours of exposure to sunlight, and after this period is lost.

Ransom and Sheridan showed that tubercle bacilli in sputum and in culture, and also in dry and finely divided material exposed to the action of light and air, quickly lose their virulence.

Sawizky undertook two sets of experiments, in one of which tubercular sputum was dried and preserved in a dark place; in the other the sputum was exposed for various periods to the action of sunlight. His results show:

1. That in ordinary living-rooms dried tubercular sputum retains its virulence for a period of two and a half months.

2. The virulence of such a sputum is not suddenly but is gradually lost.

3. Dried tubercular sputum exposed to the action of direct sunlight loses its virulence similarly to sputum kept in the dark.

The results of these different authors on the action of light on tubercle bacilli in sputum thus appear to be somewhat at variance, and the action of light on the organisms in sputum expectorated on the sidewalks of public thoroughfares under all the varying conditions of wind, sunshine, and rain of an English climate, still requires further investigation.

I have conducted a few experiments with this object in view. A quantity of muco-purulent sputum from a case of pulmonary tuberculosis, which showed on microscopic examination a fair number of tubercle bacilli in every field, was divided up into small masses as nearly as possible of the same size as would be ordinarily expectorated by a person on to the footpath. These

were exposed to the action of sunlight for varying periods of two, four, six, eight, twelve, twenty-four, and forty-eight hours, on four days having an average temperature during the day of about 65° F., and a light breeze. It was noted that already in two hours drying had progressed to form a skin at the edge of the mass, and that complete drying of the whole occurred in six to eight hours.

Twenty-four hours of exposure to sunlight, during which period there were about eight hours of direct sunshine, and for the rest the sun was lightly clouded over, failed to kill the tubercle bacilli, as shown by inoculation into guinea-pigs.

All the specimens exposed for periods of from two to twenty-four hours were found to contain virulent tubercle bacilli. Forty-eight hours' similar exposure, however, killed the bacilli. It is thus certain that in the ordinary course of events a tubercular expectoration exposed to sunlight in a public thoroughfare may contain living and virulent tubercle bacilli for a period of two, three, or even four days, according to meteorological conditions of wind and sunshine, and that even after having become quite dry it may contain living bacilli for as long as one day.

The occurrence of tubercular sputa among the many masses which testify to "the disgusting and dangerous habit" of expectorating in the public thoroughfares of all large towns was also demonstrated. Expectorations on the footpaths were collected during the winter months by means of sterilized swabs, and placed in sterilized test-tubes. Portions of each were inoculated subcutaneously into two guinea-pigs, which were kept under observation during the subsequent eight weeks or more. Other portions were used to make two smears from each on glass slides, which, after being stained by Ziehl Niellsen's method, were examined under a one-twelfth O.I. objective. Mucous, muco-purulent, and purulent accumulations were taken indiscriminately, only the most liquid expectorations being neglected.

Neglecting those cases which resulted in the death of both experimental animals within a few days, out of 105 sputa collected, 5 were proved to contain virulent tubercle bacilli

—a percentage of 4·76—3 of the 5 being demonstrated microscopically. Some of the collections were certainly nasal secretions.

The number of these sputa expectorated on to the sidewalks of the principal streets of large towns during the day reaches a large figure. On one occasion I tried to count all those visible between ten and eleven o'clock in the morning, during a slow walk occupying one hour, along the most frequented streets of Liverpool. But the actual expectorations were far too numerous to count, so that all very liquid ones were omitted, and note was taken only of those which appeared to have been recently expectorated, and which consisted of more or less thick mucous, muco-purulent, or purulent discharges.

Brownlow Hill (part between University College and Lime Street)	72
Ranelagh Street	14
Church Street	10
Lord Street	11
Castle Street	7
Dale Street	30
William Brown Street	5
London Road	18
Pembroke Place	16

These figures give only a very faint idea of the extent of the expectoration which is going on each hour in the streets, and consequently of the extent to which pedestrians are subjected to infection by tubercle bacilli.

Besides the possibility of the masses drying in a few hours, and of the bacilli being carried and thrown about in the dust of the air, sputum also soils the boots of passers-by, but more particularly the trailing edges of ladies' skirts, tubercle bacilli becoming freely distributed into offices, shops, dwelling-houses, etc., by this means.

It is evident, therefore, that the indiscriminate expectoration of tubercular sputum into public thoroughfares, and particularly on the sidewalks of streets, is a danger the extent of which cannot be at present exactly defined, to the public health, and measures for its prevention must be considered by sanitary authorities.

A SERMON

PREACHED BEFORE THE CONGRESS IN THE PRO-CATHEDRAL

BY

THE RIGHT REV. THE LORD BISHOP OF LIVERPOOL, D.D.

"Neither shall there be any more pain" (REV. xxi. 4).

THERE is a well-known painting by a German artist in which Satan is represented playing at chess with a man for his soul. Professor Huxley, in one of his lay sermons, has used this picture as an illustration of human life, but he has modified its conception, and has brought it nearer to the truth. For the mocking fiend he substitutes a calm and strong angel, who is playing for love, and who would rather lose than win. The chess-board, he says, is the world; the pieces are the phenomena of the universe; the rules of the game are the laws of Nature. The angel is hidden from man, but his play is always fair, just, and patient; yet he never overlooks a single mistake, never makes any allowance for ignorance. If the man play well, the highest stakes are paid with overflowing generosity; if he play ill, he is checkmated without haste and without remorse.

Such a view of life may satisfy a Deist, but it fails to appeal to a Christian. He, as a living theologian suggests, paints his hidden antagonist very differently. To him he is not a calm and strong angel, but a Father, Who desires man to win, Who teaches and helps him how to win, and Who, all through the game, is educating His child and overruling his mistakes; Who does not allow a wrong move to end in certain disaster, but Who, through failure, trains him to succeed, and transforms his very punishments into blessings.

About one of the pieces on this board, which God is continually using, I desire to speak this morning. That piece is *suffering*.

The meeting of the Health Congress in this busy city, where the making of money is apt to become the main object of existence, and where a material view of life tends to limit a man's outlook, and to distort and to dwarf his character, is a significant

fact. It is a powerful reminder that wealth is not the chief end of living, and that a city or a nation is a fearful loser if it accumulate riches at the cost of physical health, intellectual vigour, or moral virtue and happiness. It re-echoes by its very presence the words of our Divine Master, "A man's life consisteth not in the abundance of the things which he possesses."

And the attendance of the Congress in this cathedral—soon about to give place to one far worthier of the National Church and of the second port of the Empire—has its significance also. It tells of the real unity that exists between true religion and true science. The physician and the theologian, the man of science and the man of religion, are not antagonists, but the humble servants of the same great Lord. In old times the offices of priest and physician were united in one person. To-day they are still knit together by the study of the great problems of life; by a common aim to improve the conditions of human living; and by a common faith that the golden age lies before, and not behind. From opposite sides, it has been well said, both watch the interdependence of the material and of the spiritual. The physician takes account of the action of the spirit when he seeks to restore health to the body; the theologian takes account of the action of the body when he seeks to establish and to develop the health of the soul. Both labour in their several callings as fellow-workers with God, inspired by the thought that it is through them that He is pleased to reveal part of His will in many ways and in many fragments. It would be an irreparable loss to mankind if these fellow-servants were ever to part asunder, and to forget to fulfil their allotted task with one heart and with one soul, and to be animated by the same great conviction that "now we know *in part*." For if what we see were all, our condition would be like that of her of whom our great poet sings:

> "And Death and Life she hated equally,
> And nothing saw, for her despair,
> But dreadful Time, dreadful Eternity,
> No comfort anywhere."

But what we see is not all. Clouds, born of earth, may hide the light of heaven for a time; they cannot quench it. "As we

learn to believe that there cannot be one lost good, so we learn to believe that there cannot be one fruitless pang."

Not one fruitless pang! The presence of suffering in God's universe, which this Congress is helping mankind to meet and to alleviate, cannot be explained. It is only part of a still larger problem—the existence of evil. "We are not practically concerned to know why the constitution of things is not other than it is, but we are practically concerned to know what that constitution is, and how we are to order ourselves in respect to it." Christianity differs from other religious systems which are not Christian in this way, among others, that it throws light on some of the greatest problems that perplex men. It takes the sting out of *death* by revealing a life to come; it shows the gravity of *sin*, and yet it shows also its cure and its pardon; and it explains *pain* as one penalty of sin, and as a discipline administered by the all-wise, almighty, and all-loving Hands which rule the world.

There are three uses, amongst others, to which God puts suffering, not to checkmate, but to benefit and to bless His creatures. In His hands suffering warns, educates, and illuminates.

1. *It Warns.*—Pain is Nature's danger signal. As a rule every derangement of the body signals its presence by pain. When anything goes wrong pain at once warns us. It prevents the imprudent use of the diseased member; it teaches the danger of walking with a sprained foot or of working with an inflamed eye; it directs us to the place where the remedy should be applied; it constantly assists the physician in localizing the seat of disease. But for pain, like travellers benumbed by Arctic cold, we should be liable to lose part of our body without knowing it. So long as death remains, we could not wish the entire removal of suffering.

Nor is this all. Pain warns those who have suffered once to avoid what will cause them to suffer again. "A burnt child dreads the fire." And it is a striking fact that when mortification has gone so far that no remedy is possible, then pain ceases.

This beneficial use of pain is taught us by experience.

2. *Suffering Educates.*—It disciplines the character. This disciplinary use of suffering depends largely upon ourselves. Suffering may curse as well as bless. On either side of our blessed Lord on the Cross of Calvary hung a sufferer. To one, pain opened the gates of Paradise; to the other, it was the herald of blasphemy and despair.

(*a*) Suffering educates the *conscience.* It brings home to us the sinfulness, and the danger, and the misery of sin. If the practice of sin were perfectly consistent with happiness, it is not easy to see how we could feel any hatred of sin, or dread to fall into it. If we could feel as happy after we had sinned as before, how could we persuade ourselves that God was really displeased with our conduct? As it is, even a delay in the punishment tends to lead men to be content with the ways of evil. "Because sentence against an evil work is not executed speedily, therefore the hearts of the sons of men are fully set in them to do evil." Suffering teaches us that God's laws are their own executioners; that the way of transgressors is hard; that punishment is not arbitrary, but the natural consequence of disobedience to just and wise laws, as natural as it is for fire to burn the careless, or for the strong current to carry the rash swimmer over the cataract to which he has drawn too near.

(*b*) Suffering educates the *heart* which a spell of prosperity is apt to harden. A sickness teaches us what it means for others to be ill. A man upon his bed of suffering says to himself, "This is what my friend, or my neighbour, must have endured." Death takes away a child or a wife, and we understand the language and the anguish of some acquaintance whose sorrow seemed to us, at the time, exaggerated. In the school of suffering we best learn the lesson of sympathy.

(*c*) Suffering educates the *sluggish will.* Without pain earth would not be the nursery of human virtue, and virtue is a higher blessing than happiness. Without pain there would be no heroes. The elect spirits in the army of God are trained by suffering. The Lord Himself learned obedience by the things which He suffered. God has one Son without sin, but He has no sons without suffering. "Poets learn in suffering what they teach in song." Goethe could say, "I have had no affliction

which did not turn into a poem." A man who has never known suffering has a serious lack in his character. It is "through much tribulation that we enter into the kingdom of heaven." It is by suffering that God's servants are trained to serve Him on earth and to reign with Him in heaven.

3. *Suffering Illuminates.*—It reveals to us God, and ourselves, and our fellow-men: as the darkness of the night brings out the stars which the splendour of the day has hidden.

(*a*) It reveals *God.* It brings home to us aspects of His character which we are apt to forget in times of rude health. It teaches us to know that He is holy and righteous and infinitely just. In pain and weakness we learn that God's judgments are abroad in the world, and that He does not wink at moral evil, as we are apt to think in days of prosperity and vigour. Suffering reveals His love. The broken heart, which has trifled with its religious convictions, in the hour of trouble turns to Him and learns the secrets of His Fatherhood. "Before I was afflicted," sings the Hebrew psalmist, "I went astray, but now have I kept Thy word." Pain brought many to the feet of our Lord when He was upon earth. They only flocked to Him because they were sufferers. The hand of God touched them, and they came to be healed and helped.

(*b*) Suffering reveals *us* to ourselves. It brings home to us our weakness, our selfishness, our lack of faith. It teaches us the greatness of God's mercy, and the depths of our own ingratitude. We value the slightest blessings far more highly when we come back to them from a bed of pain:

> "See the wretch that long has tossed
> On the thorny bed of pain
> At length regain his vigour lost
> And breathe and walk again.
> The meanest floweret of the vale,
> The simplest note that swells the gale,
> The common sun, the air, the skies,
> To Him our opening Paradise."

(*c*) Suffering reveals the character of *others.* We learn their generosity or their heartlessness. We learn how our dear ones love us, and how we love them. We see love eloquent in self-sacrifice. We appreciate and return that love as perhaps we

never should had it not been for those tender ministries in our hours of pain and weakness. The sufferings of one member of a family draw out the sympathy and care of all the rest, especially of those who have themselves suffered. Too often we forget that we are all one in Christ Jesus, and that, in spite of the differences of rank, wealth, and education, we are members of the same great family, and one of another. "One touch of nature makes the whole world kin," and one of the greatest of unifying forces is suffering.

If pain, then, be so great a blessing, is it not our wisdom to leave it alone?

Nay. In itself it is an evil. It is only the love of Omnipotence that overrules and transforms it into a blessing in some of its effects. The Bible never calls evil good, and never commends pain for its own sake. It represents the whole creation as "groaning and travailing in pain together until now"; and men, "which have the first-fruits of the Spirit," as "groaning within themselves, waiting for the adoption, to wit, the redemption of their body." Christian revelation foretells the disappearance of pain. And it is the glory of such a Congress as this that it is working together with God to hasten the dawning of this golden age. Already science has done much to detect the sources of disease, and to discover the remedy. By the use of anæsthetics it has wonderfully alleviated human suffering. By the antiseptic treatment of wounds it has quickened recovery in an extraordinary degree. By the application of scientific discoveries to the conditions of modern society in town and in country, it has checked disease, prolonged the average length of human life, and increased the sum of human happiness. What it has done is but a foretaste of what it will do. And the humblest man of science, toiling in his study or laboratory or hospital with undaunted will and reverent soul, as in the presence of the Lord of the Universe, will find his task transfigured by the knowledge that he is helping to work out the purposes of God, and to bring nearer the time when suffering shall pass from the board of the world, when "God shall wipe away all tears from our eyes, and there shall be no more death, neither sorrow nor crying, neither shall there be any more pain."

THE LIVERPOOL CONGRESS.

The Congress which has just concluded its sittings in the City of Liverpool was certainly one of the most successful meetings The Royal Institute has held. Throughout, the work of the sections was well sustained, and the attendance day by day was most gratifying to the sectional officials, who had spared no pains to make their respective sections attractive by the excellence of the papers provided and the important subjects which they had arranged for discussion. As will be seen, there were no less than ten sections, and the interest in each was sustained to the last. The sections met in the buildings of the University College, and the members therefore had the opportunity of seeing the magnificent buildings and laboratories which are growing up to complete the new University of Liverpool, a tribute alike to the generosity of the inhabitants and to the eminence of the professorial staff.

The Council could not have selected a more admirable place for the meeting, for the City of Liverpool, thanks to the public spirit of its governing authority, presents innumerable object-lessons of public health activity and enterprise. These were set out in detail in a large and handsome volume, profusely illustrated, and which forms a most valuable record of the progressive spirit which animates the inhabitants of this important city.

The hospitality extended to the members on all hands was very great, and the visit to Liverpool, in addition to being most profitable, was also very enjoyable.

The Congress was presided over by the Earl of Derby, K.G. —a selection which contributed largely to its success—but to the Lord Mayor and to Dr. Hope the thanks of The Institute are more especially due. The former, as Chairman of the Executive Committee, had not only been responsible for much of the organization for the meeting, but throughout its course, in spite of other pressing public duties, was unremitting in his attendance and interest in its progress. The zeal and great ability of Dr. Hope are too well known to call for any comment; but these qualities, combined with great organizing power and consideration for others, made Dr. Hope an ideal Secretary, and to him The Institute is in the main indebted for the brilliant success which attended its Liverpool Congress.

It is now sincerely to be hoped that all those who attended the meeting will strive to help forward the work which The Royal Institute is pursuing, and make it strong both in numbers and influence.

THE LIVERPOOL CONGRESS.

July 15th to 21st inclusive, 1903.

FIRST GENERAL MEETING.

Opening Proceedings.

The inaugural meeting of the Congress was held under the most successful conditions in St. George's Hall, on Wednesday, July 15, at 8 p.m.

All the approaches to the Hall were decorated with evergreens and flowers, and in the Hall itself there was an elegant display of palms, plants, and flowers. The scene inside the Hall was of a very animated description, for long before the time appointed for the formal opening it was filled with members of The Royal Institute, delegates, and a large number of ladies.

The President's procession, the members of which having previously robed in the library, consisted of the Mayors delegated to the Congress, the Officers and Council of The Royal Institute of Public Health, the Officers of the Congress, together with the Presidents, Vice-presidents, and Secretaries of the sections, the Professors in University College, Liverpool, the members of the City Corporation of Liverpool, the magistrates of the city, the Consuls of Greece, Chili, and Mexico, the Archimandrite Zervaes, the Principal of the University College, the Right Rev. The Lord Bishop of Liverpool, Sir William Henry Broadbent, Bart., M.D., K.C.V.O., Professor Sir Michael Foster, M.D., F.R.S., M.P., and many others.

The Right Hon. the Earl of Derby, K.G., was supported by the Right Hon. The Lord Mayor of Liverpool (W. W. Rutherford, Esq., M.P.), and The President of The Royal Institute of Public Health (Professor William R. Smith, M.D., D.Sc., F.R.S. Edin., J.P.).

The Right Hon. The Lord Mayor of Liverpool, who occupied the chair at the commencement of the proceedings, was, on rising, received with applause. He said:

My Lords, Ladies and Gentlemen,—I would in the first place desire to say, on behalf of the Corporation of Liverpool, and also

ST. GEORGE'S HALL, LIVERPOOL.

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for myself, how very cordially we welcome the members of the Congress of The Royal Institute of Public Health to Liverpool, an Institute to which all interested in the solution of public health problems owe so much, and one which, consequent upon its good work, had earned royal recognition and patronage.

These annual meetings, I am sure, afford a most excellent opportunity for the interchange of ideas and of experience, and that is, after all, the great distinguishing feature of mankind as against all other creatures, and is in itself the foundation of all advancement and human civilization. It was always necessary, and more than necessary, in matters of public health, for such opportunities to occur. The highest form of emulation is surely that of emulation in good and useful work, and hence it is that such meetings as the one we are now inaugurating contributed so largely in all parts of the kingdom to greater efforts for the public health improvement of the people. I desire to acknowledge the deep debt of obligation which the city and the Congress owe to our friend and neighbour, the Earl of Derby. By accepting the presidency of the Congress, his lordship had added another to those graceful and considerate acts of friendliness which have endeared the house of Stanley to the City of Liverpool for so many years. In Lord Derby we have an ideal president; in Dr. Hope, our able health officer, we have an ideal secretary; and in Professor Rubert Boyce, of University College, President of the Bacteriological Section, we have a tower of strength and energy and organizing force. I welcome very heartily the delegates to Liverpool, and trust they will have a pleasant and instructive series of meetings. The Lord Mayor then called upon the President of The Royal Institute to invest the Earl of Derby with the chain and badge of office.

Professor William R. Smith, the President of the Institute, on rising, was received with applause. He said that he wished in the first instance to thank the Lord Mayor for the kind words of welcome which he had extended to the members of the Congress, and begged to assure him that they experienced a peculiar pleasure in visiting the City of Liverpool, which had been notably characterized for the energy of its people in educational and

municipal work. Those of them who came from London had watched with something akin to envy the great strides made by University College, but they would all hail with the greatest possible pleasure and satisfaction the advent of a university in the city. He assured the Lord Mayor, the Principal, and the staff of University College of their best wishes for the success of the movement. In municipal work Liverpool occupied a peculiar position, as it had duties connected with the administration of the port in addition to the duties naturally falling to a city council. Those present who came from other parts of the kingdom like himself wished to acknowledge their indebtedness for the admirable administration of the port of Liverpool. That administration was felt in every part of the country. There was a great danger of the introduction of disease into their midst consequent upon the large number of persons entering the country from abroad, but owing to the admirable arrangements made by the Port Sanitary Authority, ably seconded by its staff of officials, they had, fortunately, so far as Liverpool was concerned, not to lament the introduction of diseases which might otherwise have found a place amongst them. Liverpool had also long taken a foremost place in municipal work. It had taken under its control almost everything it could municipalize. Its system of tramways was most excellent; its water-supply was of the best; and its efforts in the direction of the proper housing of the poor were most praiseworthy. The Congress met under peculiarly satisfactory auspices in having the Earl of Derby occupying the presidential chair. The house of Stanley for centuries had enjoyed the respect and esteem of the people of this country, and at no time did it command this respect more than at the present time. In Lord Derby they had a President of vast official experience, for he had served the State at the Admiralty, the War Office, the Board of Trade, and as Governor-General of Canada, since which time, as Lord Mayor of Liverpool, he had acquired great practical experience of municipal life, and of the many social problems they were met to discuss; and he was informed on the best authority that, amongst the many excellent Mayors and Lord Mayors, Liverpool had been fortunate

in having, not one had excelled Lord Derby in the assiduity and dignity with which he had discharged the duties of that high office, and that his good influence was felt even at the present time. They also knew how deeply interested he was in all public health questions; how ably he presided over the Committee of the Tuberculosis Congress two years since in London; and how he had always evinced the greatest sympathy with all questions having for their object the welfare of the poorer classes in the country.

The Council of The Royal Institute of Public Health, in recognition of the eminent services of Lord Derby to the public health, had unanimously elected him an Honorary Fellow of the Institute, the diploma of which I have now the honour and privilege of handing to his lordship, and I invite him to sign the roll, which contains the signatures of some of the most noble and distinguished men in the world.

The President then handed to the Earl of Derby the Diploma of an Honorary Fellow, and his lordship signed the roll of Honorary Fellows.

The Earl of Derby expressed his deep appreciation of the great honour conferred upon him on his election as an Honorary Fellow of The Royal Institute of Public Health, and said that during the course of his life he had been the recipient of many honours, but that there was none he valued more than the Fellowship which had just been conferred upon him.

The President then invested his lordship with the chain and badge of office as President of the Congress. The Earl of Derby thereupon took the chair, which was vacated by the Lord Mayor of Liverpool amidst much applause.

The President of the Congress then delivered his presidential address, and subsequently handed the Harben Gold Medal for 1891 to Sir Charles A. Cameron, C.B., M.D., F.R.C.P. Irel., and that for 1892 to Professor William R. Smith, M.D., D.Sc. F.R.S. Edin.

The Mayor of Birkenhead (Dr. Owen Morris), in proposing a vote of thanks to Lord Derby, paid a tribute to the splendid services of that nobleman. He went on to remark that there was no use in having building and other regulations, if the people

could not be induced to keep their rooms properly ventilated. They should also be taught to properly select and cook their food. The health and progress of the nation must in the main depend on the people themselves. The question of overcrowding was, in his opinion, not nearly so responsible for the deterioration of the working classes as the want of proper rest. He advocated the earlier closing of places of amusement, and the abstention from tobacco and alcohol, especially cigarettes in the young.

The Lord Bishop of Liverpool said he was glad that it was the province of the Church to second what the State had proposed; if good health was one condition for good citizenship, it was also one qualification for wise Churchmanship. If many of the superstitions and blunders which Churchmen had made in the past were traced to their proper cause, it would be found that they arose from a disordered brain, caused by a disordered body. Liverpool, thanks to its fine situation, was a healthy city, and, owing to the public spirit of its citizens, everything was being done to make it even more healthy in the future. He heartily wished the Congress every success in their deliberations.

Sir William Mitchell Banks, LL.D., F.R.C.S., etc., said nothing more true had ever been said than the dictum of a popular statesman that "health was everything." If we degenerated as a people, there would be an end of us. No wealth, no imperial assumption, no armies, would keep us the great nation we had been unless we kept the health of the bulk of our people to the level of what it once was. That our health as a nation was getting worse there could be no doubt. The good blood of the country in the old days had been lost in the narrow lanes and sewers of the city, and it was pitiable to think of it.. Where, in the future, to draw the strong men and sturdy women who were the fathers and mothers of the present race they did not know, and it was the most serious of our national concerns.

The Mayor of Dover, the Chilian Consul-General, and Sir Charles A. Cameron, C.B., supported the resolution.

The President of the Congress having replied, the proceedings terminated.

THE MUNICIPAL OFFICES, LIVERPOOL.

From a photo by Messrs. Brown, Barnes and Bell, Liverpool.] [*To face p.* 479.

ENTERTAINMENTS AND EXCURSIONS.

Thursday, July 16.

VISIT TO PORT SUNLIGHT.

BY the kind invitation of Messrs. Lever Bros., some 300 delegates had the opportunity of visiting their model village and soap works. Lunch was served in the Hulme Hall, where W. H. Lever, Esq., presided, being supported by the President of The Royal Institute of Public Health and Sir Charles A. Cameron. During the course of the luncheon, the President rose and asked the company to drink to the good health of Sir Charles A. Cameron, who celebrated his birthday that day, and added that he was sure everyone connected with the Congress would join in wishing him very many happy returns of the day.

The toast was enthusiastically received with musical honours, and Sir Charles A. Cameron feelingly replied.

The President then proposed the health of Mr. W. H. Lever, and prosperity to the firm of Messrs. Lever Bros. He commented upon the beautiful appearance of the village, which, he said, consisted of 580 houses, with a population of about 3,000 persons. As showing the healthiness of the village, he remarked that the death-rate last year was only 9·8 per 1,000, but the birth-rate was 56 per 1,000. The owners of Port Sunlight paid two-fifths of the total rates of Bebington township, and apparently received nothing in return from the Council, for they maintained their own roads, lighted them, and generally looked after the well-being of the village themselves. A large number of those present would like to receive similar relief to the rates of their own districts.

Mr. Lever, in reply, said the village was no wonder at all. The whole question of health involved was the number of houses they built to the acre. He thought the maximum should be ten, and if they got twenty the death-rate went up, and so on until it came to fifty to the acre, when it became a congested area, and they condemned a number of children who came into the world to leave it very soon, and condemned many others to ineffectual, unhappy, and

short lives. They were trying no experiment in Port Sunlight, but the people who were experimenting were those who were trying how long people could live in slums. By the time they had proved people could live in slums there were none left to live there. And in the meantime they were damaging the community by reducing the working capacity of the whole country. In conclusion, he said Messrs. Lever Bros. gave a particularly hearty welcome to all connected with public health and social advancement, and he wished The Royal Institute of Public Health and its Liverpool Congress every success.

Subsequently the party went through the works, and inspected some of the houses, being afterwards entertained to tea.

Visit to the s.s. "Sobo."

Through the kindness of Messrs. Elder, Dempster and Co., a number of delegates visited this fine West African vessel, and were most hospitably received.

Reception at the Walker Art Gallery.

By the invitation of the local executive committee, a very enjoyable conversazione was held in the Art Gallery, in the upper vestibule of which the guests were received by Sir William and Lady Forwood. The arrangements were excellent, and a most enjoyable social evening was the successful result. The pleasant rooms were reached by a crimson stairway bordered with marguerites, and the reception landing was most attractive with gorgeously tinted rugs and lounges, with groups of palms and white flowers placed at intervals. The fountain was playing in the centre room, which was beautifully decorated with fuchsias and pale green foliage. Little in the way of entertainment was necessary beyond the collection of pictures, which could not fail to afford much pleasure to all. Music was provided by the Euterpean Ladies' Orchestra, directed by the Misses Emilie and Annie Scott in the Picton Reading Room, and in the Art Gallery by the Carmen Sylva Orchestra, under the direction of Miss Florence Pickering. The exhibition of old and rare books in the Picton Reading Room was of the greatest interest.

Refreshments were served in the Statuary Gallery.

Friday, July 17.

LUNCHEON BY THE LIVERPOOL PORT SANITARY AUTHORITY.

THE members of the Section for Port Sanitary Administration were entertained at luncheon in the Clarence Hotel, Alderman Thomas Clarke, M.D., J.P., in the chair.

The toast of the Liverpool Port Sanitary Authority was responded to by the chairman, and that of the Visitors by Sir Michael Foster, M.D., M.P., K.C.B.

CRUISE ON THE MERSEY.

By the kind invitation of the Mersey Docks and Harbour Board, a party of visitors took a cruise on the Mersey in the s.s. *Galatea.*

GARDEN-PARTY AT CALDERSTONES.

The Right Hon. the Lord Mayor of Liverpool and the Lady Mayoress gave a garden-party at Calderstones to the members of the Congress, which was largely attended. The guests entered cordially into the programme of amusement provided for them. Everything was done with boundless generosity and with a forethought which took heed of variable English skies. The wide airy house, empty of furnishings save Turkey rugs and chairs and tables, gave space enough for shelter and shade. Great bushes of hydrangea and big palms were grouped in the corridors, in the hall, and in the porch, which is almost Corinthian in design, with high fluted pillars and an arched doorway. The grounds are of the finest English type, with wide reaches of lawn, great ancient trees, and lovely wildernesses and groves. At the beginning of the reception, when the sun stretched in level lines across the grass, it was possible to see the beauty of the surrounding landscape, with its gay open spaces, its winding paths, its avenues of beeches and larches, with their canopies of delicately interlaced leaves. A tree-fringed lawn formed a charming stage for scenes from "Dorothy," which were given by Madame Nourry and friends, and picturesque peasants, in bright skirts and kirtles and rose-wreathed bonnets, danced and sang under the greenwood-tree in the merry fashion of days that are

gone. There was good music by the Liverpool Constabulary Band and the band of the 2nd Volunteer Battalion of the Liverpool Regiment. Refreshments were served on the lawn at tables gaily decorated with pink and white poppies, as well as in the billiard-room and morning-room.

Dinner to the Presidents, etc.

In the evening, at the Adelphi Hotel, the President of The Royal Institute entertained the Presidents of the Sections and other chief officials of the Congress with other guests to dinner.

Saturday, July 18.

Chester and Eaton Park.

A large party of delegates visited Chester and Eaton Park. They were received at the station by the Mayor of Chester, and at once proceeded to the Town Hall, where they were shown the various rooms and many valuable and ancient documents. After visiting the Cathedral and most of the interesting parts of the city, they had luncheon at the Grosvenor Hotel, which was presided over by the Mayor. The toast of the Mayor and City of Chester was proposed by the President of The Royal Institute, and responded to by the Mayor.

The party subsequently proceeded by river to Eaton Hall, the seat of the Duke of Westminster, where they were entertained to tea.

Chester and Hawarden.

A party proceeded to Chester and Hawarden Castle. At the latter place they had the privilege of seeing the library and many interesting relics of the late Mr. Gladstone.

Isle of Man.

A large party proceeded to the Isle of Man, where they were hospitably entertained to luncheon by the Mayor and Corporation of Douglas, the Governor, Lord Raglan, also being present.

The toast of the Mayor and Corporation was proposed by Major Ronald Ross, C.B., F.R.S., and responded to by the Mayor.

The party subsequently proceeded to Ramsay in electric cars, where tea was provided.

THE TOWN HALL, LIVERPOOL.

From a photo by Messrs. Brown, Barnes and Bell, Liverpool.] [*To face p.* 483.

Rivington.

Another excursion was arranged to the Corporation Waterworks at Rivington. Luncheon was provided, at the invitation of the Corporation, at the Royal Oak Hotel, Chorley.

Northwich Salt Mines and the Delamere Forest Sanatoria.

This party, after a most interesting visit to the salt mines, were entertained at luncheon by the Northwich Urban District Council. The members subsequently proceeded to the sanatorium at Delamere, where tea was provided, and the thanks of the party were expressed by Sir William Broadbent, Bart., M.D., K.C.V.O., F.R.S.

Llandudno and Menai Straits.

A party proceeded to this interesting and prosperous town, where they were generously entertained by Shaw Thewlis, Esq., the Chairman of the Llandudno Sanitary Committee.

Norton Water Tower, Runcorn Bridge and Pathological Farm.

A further party proceeded on this interesting excursion, which proved most instructive and enjoyable.

Sunday, July 19.

The members of the Congress assembled at the Town Hall at 10.30 a.m., all wearing their municipal or academic robes. A procession was formed headed by eight mace-bearers under the charge of the Sergeant-at-Mace. The Right Hon. the Lord Mayor of Liverpool followed, accompanied by the Town Clerk, the President of The Royal Institute, the Honorary General Secretary of the Congress, the representatives of universities, university colleges, the Council of The Royal Institute, the Mayors and Town Clerks of boroughs, the Chairmen of Sanitary Authorities, the aldermen, councillors, prominent citizens, and members of the Congress. In the Mayoral state carriage were the Lady Mayoress, Miss Smith, and Miss Freda Rutherford.

The procession proceeded to the Pro-Cathedral, where the sermon was preached by the Right Rev. the Lord Bishop of Liverpool. The hymns used in the service were " All people that on earth do

dwell" and "O God, our help in ages past." At the close of the service the National Anthem was sung, and the procession returned to the Town Hall.

Monday, July 20.

1. A visit was paid to Messrs. Reece and Son's Working Dairy, where luncheon was generously provided.

2. A very enjoyable cruise on the Mersey was arranged, and the party most hospitably entertained by the Corporation of Birkenhead.

THE CONGRESS DINNER.

This dinner was held at the Adelphi Hotel, and was largely attended, some 250 guests, of which a large number were ladies, being present.

The Right Hon. the Lord Mayor of Liverpool presided.

During the dinner instrumental music was rendered by the Carmen Sylva Ladies' Orchestra, and interspersed between the toasts songs were sung by the Cathedral Quartette.

The loving cup having been circulated, The Lord Mayor proposed: The health of the King, the Patron of The Institute; and that of Her Majesty the Queen, H.R.H. the Prince of Wales, Vice-Patron of The Institute, the Princess of Wales, and other members of the Royal Family.

His Lordship then proposed "Success to The Royal Institute of Public Health." He remarked that The Institute was founded in 1886, and that it now had the satisfactory record of having some 1,500 members, it enjoyed also the honour of possessing the patronage of His Majesty the King. He was informed that the Greek motto of The Institute literally translated was "Leadeth by the hand golden Health," and right well had The Institute acted up to its motto. On behalf of the citizens of Liverpool, he welcomed the members of the Congress most warmly, and hoped that their deliberations would be most useful, and the means of instruction to all who had been privileged to take part in them. The Lord Mayor went on to refer to the splendid book which, owing largely to the energy and ability of Dr. Hope, had just been issued, dealing with the City of Liverpool, and contended that all great cities, for reasons of history and of their reputation, should be possessed

of such a work. He coupled with the toast the name of Professor Smith, the President of The Institute, who had filled that high office for nine years, and who had that day been elected for the tenth time. They recognised the indefatigable zeal which had characterized his tenure of office, and municipal authorities in all parts of the kingdom owed much to him for the enlightened policy which had ever characterized the work of The Royal Institute.

The President, in responding, remarked that in connection with the date of the founding of The Institute he would like to remind the distinguished company present that it was consequent upon the action of The Institute that the year 1886 saw the passing of a clause in an Act of Parliament recognising that those discharging the important duties of Medical Officer of Health should have special qualifications, and one of the greatest reasons why The Institute commended itself to those concerned in municipal government was, he thought, the fact, that it was owing to that royal body, not only that proper recognition was given to Diplomas in Public Health, but also that, in consequence of legislation initiated by The Institute, they had the satisfaction of knowing that no one could now be appointed to the head of any public health administration who had not had a special training, and had not given proof of his ability to discharge the duties of such an important position. He ventured to think that the public health of this country owed a great deal to the exertions of The Royal Institute. He was happy to state that on the governing body Dr. Hope and Major Ross of Liverpool had for many years been invaluable members. He thanked them for the cordial way they had honoured the toast, and for the too flattering manner with which his name had been received.

Sir Charles A. Cameron, C.B., submitted "Municipal and Sanitary Authorities," asserting that the municipalities of the United Kingdom, and especially that of Liverpool, were well administered. He was going that night across to Ireland, and he would not mind telling them in confidence that he would be amongst the 95 per cent. of the Irishmen who would extend to His Majesty the King a welcome that could not be surpassed in any part of the United Kingdom.

The toast was responded to by Colonel Hobart, J.P., D.L., and Sir Wollaston Knocker, C.B., Town Clerk of Dover.

Dr. Hope proposed the health of "The Visitors," and to this toast Sir Edward Russell and Colonel Crombie, C.B., of the India Office, responded.

Sir William M. Banks proposed the health of Dr. Hope, to whose great exertions the success of the meeting was due.

Dr. Hope responded, and said that he had throughout received the greatest encouragement and help from everyone in the city.

The President of The Institute, in proposing the toast of "The Lord Mayor and Corporation of Liverpool," paid a high tribute to the worth of the Lord Mayor and the enlightened policy of the Corporation, and added that the toast would be incomplete unless he mentioned in connection with it the gracious lady who filled the office of Lady Mayoress, and who, consequent upon her kindness and consideration, coupled with great charm of manner, had endeared herself to them all.

The President then announced that the Council had unanimously resolved to elect his lordship an Honorary Life Member of The Royal Institute, in recognition of the valuable services he had personally rendered, as well as of the good work of the Corporation, and invited his lordship to accept the diploma as such, and to sign the roll.

The Lord Mayor, having signed the roll, suitably responded, and the dinner closed with the National Anthem, all subsequently joining in singing "Auld Lang Syne."

Tuesday, July 21.

Sir Alfred L. Jones, K.C.M.G., President of the Liverpool Chamber of Commerce, entertained at luncheon, in the Clarence Hotel, the members of the Tropical Section, and representatives of the London, Liverpool, and Manchester Chambers of Commerce; and subsequently a conference on "Sanitation in West Africa" took place, when resolutions similar to those passed by the Congress were agreed to, and copies directed to be forwarded to the Secretary of State for the Colonies.

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FINAL GENERAL MEETING OF THE CONGRESS.

Closing Proceedings.

The final General Meeting of the Congress was held at noon on Tuesday, July 21, in the Arts Theatre of University College, Liverpool, Professor William R. Smith, M.D., J.P., the President of The Royal Institute, presiding.

The Presidents of the various sections presented reports of the work of their respective sections, and submitted the resolutions which had been passed as follows:

1.—Sanitation of Congested Areas and Rehousing the Dispossessed.

1. "That in the opinion of this meeting it is absolutely necessary that the period for repayment of loans under the Housing of the Working Classes Act, 1890, should be extended, and that this amendment should be enforced speedily."

2.—Preventive Medicine.

1. "That this 1903 Congress of The Royal Institute of Public Health, held at Liverpool, approves of the efforts made by the Worshipful Company of Plumbers, in promoting the Plumbing Registration Bill, believing that such a measure will be for the safeguarding of the public health, and beneficial to all classes of the community, and appeals to the Government to give facilities and support to the measure."

2. "That the present system of vaccination, partly by public vaccinators and partly by general practitioners, leads to inefficiency and friction, and that the Council be requested to consider this matter."

3.—Section of Bacteriology and Comparative Pathology.

1. "That this meeting do appoint a select Committee of practical bacteriologists, with experience of water analysis, consisting of not less than three, and not more than twelve, members, to report to the next Congress of this Royal Institute the methods which it considers most suitable for universal adoption in the bacterioscopic analysis of water-supplies, and that Professor Boyce be equested to act as Chairman of such Committee."

2. "That this meeting, recognising that tuberculin is a certain diagnostic test for tuberculosis, is of opinion that tuberculosis in animals should be scheduled under the Contagious Diseases of Animals Act."

3. "That this meeting approves of the principle of compensation in the case of live cattle condemned for tuberculosis, such compensation being conditional upon a scheme being formulated for the extirpation of bovine tuberculosis."

4. "That it is expedient that a Minister of Public Health should be appointed, and that in such a Department there should be a Veterinary Sub-Department, with a Veterinary Officer at its head."

4.—Tropical Sanitation.

1. "That a fully qualified Medical Officer of Health, with an adequate sanitary staff, should be appointed to each of the principal West African towns, whose sole duty it shall be to attend to sanitary matters in those towns.

2. "That there should also be appointed for all the West African Colonies an expert Sanitary Commissioner, on the Indian model of sanitary organization, the duties of the said Commissioner being as follows:

"(*a*) To spend at least half the year in visiting as many parts of the said Colonies as possible, for the purpose of inspecting and reporting upon the state and progress of sanitation in them, such report being made direct to the Colonial Office, as well as to the Government of each Colony.

"(*b*) To supervise sanitary statistics and to advise the Colonial Office regarding sanitary measures of importance.

3. "That the Colonial Office be asked to publish annually a sanitary report containing reliable statistics of the sickness and mortality, especially among Europeans, in the said Colonies, and also giving details of the sanitary work done in them, such report to be of the nature of the annual report published by the Sanitary Commissioner of the Government of India."

6.—*Child Study and School Health.*

1. "That a Committee be formed to consider the possibility of carrying out some scheme whereby the teeth of the children of Liverpool may be systematically inspected."

2. "That the Council be requested to distribute the paper on 'Dental Hygiene and National Physique,' by Mr. Norman Bennett, and the subsequent contributions to the debate by Mr. Denison Pedley and others, to the members of the Educational Committee of Liverpool."

3. "That the Council be requested to urge upon the Government the necessity for the appointment of a Consulting Medical Officer to the Board of Education, in the same way as such an officer is appointed to the Colonial Office."

4. "That the Council represent to the Government the urgent necessity for an inquiry into the physical condition of the people, and place the experience of The Royal Institute of Public Health at their disposal."

8.—*Port Sanitary Administration.*

1 "That this Section do hereby approve of the suggestions made to the Local Government Board by the Liverpool Port Sanitary Authority in regard to cases of small-pox arriving in the port, and which suggestions were unanimously approved by the Port Sanitary Association, and request the Council of The Institute to take such action in support as to them may seem prudent.

"(*a*) Detention of vessels for a reasonable time—say, not to exceed thirty-six hours.

"(*b*) Making the Port Authority and their Medical Officer of Health the Vaccination Authority and the Vaccination Officer respectively for Port Sanitary Districts, and giving powers to vaccinate and re-vaccinate.

"(*c*) Powers to deal with immediate contacts (isolation, etc.).

"(*d*) Providing penalty for withholding or for giving false information as to names and addresses."

These, on the motion of the Chairman, were referred to the Council of The Institute for the necessary action to be taken.

The following resolutions were then unanimously agreed to:

(1) "That the thanks of this meeting be accorded to the Right Hon. the Earl of Derby for his services as President of the Congress."

(2) "That the best thanks of this meeting be accorded to the Right Hon. the Lord Mayor, the Aldermen, and Councillors of the City of Liverpool, for the generous hospitality which they have accorded to the members of the Congress."

(3) "That the thanks of this meeting be given to the Right Rev. the Lord Bishop of Liverpool and other ministers for their services in connection with the Congress."

(4) "That the best thanks of this meeting be given to the Principal and governing authority of University College for their kindness in allowing the use of the College for the purposes of the Congress."

(5) "That the best thanks of the meeting be given to the Presidents, Vice-Presidents, and Secretaries of Sections for the able way in which they have organized the work of their respective Sections, which has materially contributed to the success of the Congress."

(6) "That the cordial thanks of the members of the Congress be conveyed to all those who have generously extended hospitality towards them."

(7) "That the most cordial thanks of this meeting be given to E. W. Hope, Esq., M.D., D.Sc., the Medical Officer of Health for the City of Liverpool and General Honorary Secretary of the Congress, for his able, courteous, and successful efforts in connection with its organization and conduct."

Alderman Stephen Penfold, J.P., of Folkestone, then rose and said that he had been commissioned to cordially invite The Royal Institute of Public Health to hold its next Congress in Folkestone. He assured the members that everything would be done to promote the success of the meeting, and to render it both profitable and enjoyable to those who attended. He read the following telegram which he had received from the Mayor of Folkestone: "By all means give cordial invitation to the Congress to come here next year. We will give them hearty welcome."

Alderman George Spurgen, J.P., Deputy-Mayor of Folkestone, endorsed all that had been said, and assured the members that they would, if they accepted the invitation, have every reason to be satisfied with their visit.

On the motion of the Chairman, the invitation was gratefully accepted.

The Chairman then closed the meeting with the words:

"Happy have we met,
Happy may we part,
And happy meet again."

BACTERIOLOGICAL NOTES.

I.

BACTERIOLOGY FOR GENERAL PRACTITIONERS AND JUNIOR MEDICAL OFFICERS OF HEALTH.

BY

C. J. RUSSELL McLEAN, M.D., D.P.H.,

Medical Officer of Health to the Doncaster Rural and Tickhill Urban District Councils.

(*Continued from page* 353.)

Bacteriological Examination of Water.

All waters in nature contain bacteria, the number and character varying with the source of the water, the presence and the nature of pollution, the temperature, the time the sample has been stored, and other conditions. Water from deep wells in the chalk contains the fewest micro-organisms. That from rivers, shallow wells, or stagnant pools show large numbers. They grow readily on gelatine. The *qualitative* bacteriological examination of water is not one which the general practitioner can well carry out, involving as it does prolonged subcultures and examinations, besides a large experience in recognising the different organisms; but a *quantitative* investigation can be easily accomplished, and forms a most interesting and, in my opinion, useful procedure. The apparatus required is not very extensive, as over and above the simple *incubator* and *gelatine cultures* we only need three or four *Petri dishes* (small, flat, circular dishes about 3 inches in diameter and ¾ inch deep), a 1 c.c. *pipette*, graduated to one-tenth, and a paper *counting-disc* the size of a Petri dish, divided radially into sixteen divisions. If this latter is pasted on to a piece of cardboard, it is easier of manipulation and preservation. For collecting a sample of water, a 1-oz. stoppered bottle is useful. Previous to use it must be sterilized in the hot-air oven for an hour at about 150° C. (300° F.), the stopper being replaced in the bottle as soon as sufficiently cooled. Delépine uses hermetically-sealed sterilized tubes for the purpose. If the sample is to be taken from a tap, the water must be freely run

for a few minutes before filling the bottle. The stopper may be tied down, but no wax or luting used.

As organisms in water multiply very rapidly, it is advisable to examine the sample as early as possible, otherwise it should be surrounded by ice, in order to prevent such increase in number, Cohen estimating that by such a rapid process of multiplication one microbe may, under favourable conditions, produce sixteen and a half millions in twenty-four hours.

The *quantity* of the sample required to inoculate the gelatine varies from 1 c.c. in a water of known purity to $\frac{1}{10}$ c.c. in one of doubtful character, whilst if dealing with a badly-polluted water or sewage as little as $\frac{1}{100}$ c.c. will be sufficient, this latter quantity being obtained by diluting 1 c.c. of the sample with 9 of sterile water, and using $\frac{1}{10}$ c.c. of the mixture. In some sewage even greater dilution is necessary, and the amount must be remembered in the final calculation.

The Process.

1. Sterilize the pipette and two Petri dishes in the oven at 150° C. for half an hour.

2. Melt two gelatine tubes (being sure that the medium is alkaline in reaction) by immersing their lower halves in a cup of water at about 40° C. (104° F.) for about ten minutes.

3. Draw up 1 c.c. of the sample water in the pipette, flame and withdraw the wool plug from one tube, and run in the water close down to the edge of the gelatine, holding the tube as horizontal as possible. Flame the mouth of the tube and plug.

4. Inoculate the second tube in the same manner, using only ·2 c.c. ($\frac{1}{5}$ c.c.) of the sample.

5. Mix the water and gelatine in the two tubes, not by shaking, which would generate air bubbles, but by holding each tube at the top end and swinging it round two or three times, or by gently twirling between the palms of the hands.

6. As soon as mixed and before cooling takes place, remove the plug from one tube, flame the mouth, and, having ready a sterile Petri dish on a flat surface, raise the lid just so much as to allow the mouth of the tube to pass, and pour in the gelatine. Do the same with the second tube and dish. In two or three minutes

the gelatine will have set. Label the side of the Petri *lid* with the date, hour of pouring, and the source and quantity of water used.

7. Place the poured plates in the incubator and keep the temperature at 20° C. (68° F.). Remember that gelatine melts at 24° C.

8. Examine at the *end of each twenty-four hours* and enumerate the organisms—if few, by counting all of them; if many, by placing the dish on the paper counting-disc and enumerating the colonies in two or four of the segments and estimating the total. By comparing the results from the two dishes an average can be made. Every colony visible under a hand-lens should be counted.

As a rule, *liquefying organisms*, such as *Bacillus fluorescens liquefaciens* or others, are present, appearing as little dots in the first twenty-four hours, and in forty-eight hours presenting little cups of liquid gelatine, whilst at the end of three or four days, if numerous, the liquefied areas may have run together and the whole of the gelatine become melted. It is wise, therefore, to count the colonies before this happens—say at the *end of forty-eight hours*, even although time may not have been given for other organisms to appear. Should there be none of the liquefying germs present, the plates may be incubated for several days longer, but it is wise to fix a time as a standard for comparing the same or various samples. Occasionally also one finds *moulds* present, especially if we are dealing with river or surface water samples. They grow very rapidly, and in a few days may spread over a great part of the plate, presenting a beautiful hoar-frost-like appearance. To examine moulds microscopically, a small portion of the growth should be treated with weak alcohol, together with a few drops of ammonia, and then mounted in glycerine (either stained with methylene or thionin blue or left unstained).

If desired, films may be prepared on subcultures, made on gelatine tubes, of any of the colonies presenting special interest, and an endeavour thus made to classify the organisms; but, as already stated, this is a difficult process, involving an intimate

knowledge of the whole science of bacteriology. But even without this, the *mere enumeration of* the colonies regularly undertaken in conjunction with chemical analysis of samples helps one considerably in forming an opinion of a water; and this despite the fact that many bacteriologists say that because pathogenic organisms will not grow at so low a temperature as 20° C. (most of these require 37° C. or blood heat) the process is a useless one, and the value of the test very small. Certain it is that if one finds a water sample presenting a fairly low and approximately definite number of organisms in a series of tests, if there should be a sudden rise in the number grown under similar conditions, our suspicions would be aroused that some pollution of the water had taken place, and especially so if at the same time we found an increase in the amount of organic matter over what was usually present. Again, in the case of river-water which generally requires filtration, we have an excellent means of knowing whether the filters are acting efficiently or whether they are foul and require renewing.

Several standards have been laid down as regards the number of organisms which a water may contain. For example, Koch's classification is as follows:

0 to 100	bacteria per c.c.		= a good potable water.
100 to 500	,,	,,	= a suspicious water.
500 to 1,000 or more	,,	,,	= an impure water.

The division is, however, rather wide, as some good potable waters contain over 100 organisms. And, again, if an agar plating showed only 50 or 60 colonies per c.c., but some of these were pathogenic organisms—*e.g.*, *B. typhosus*—the sample could not be placed in the first class.

Miguel says that "not more than ten different species should be present, and that rapidly liquefying organisms are a sign of pollution."

Perhaps a better plan would be, say, that a water which gives a fairly regular standard in the number of organisms present is likely to be a purer water and safer for domestic use than one which yields, say, 100 organisms per c.c. one month and 2,000

the next, as this would suggest that some impurity had gained access to the water in the interval.

NOTE.—The small "Crescent" incubator and other apparatus recommended can be obtained from Messrs. A. Gullenkamp and Co., Sun Street, London, and the staining solutions from Mr. Alexander Fraser, Teviot Place, Edinburgh.

II.

BACTERIOLOGICAL NOTES FROM FOREIGN JOURNALS.

THE USE OF EGGS AS A MEDIUM FOR THE CULTIVATION OF THE TUBERCLE BACILLI. DORSET. (*American Med.*, 3; 555, 1892.)—The method adopted by the author is to mix together the white and the yolk of eggs in test-tubes, and then, by keeping the material in the tubes at 70° C. for four hours upon two successive days, it is both sterilized and coagulated. The use of the yolk alone does not produce a very abundant growth of the tubercle bacilli, and the use of the white alone is quite unsatisfactory. A couple of drops of sterilized water is placed in each of the tubes to moisten the material, and then the tuberculous matter is inoculated upon the surface of the medium. An abundant and satisfactory growth has been obtained from tuberculous material from guinea-pigs.

UEBER DIE REIFUNG DER EDAMER KASE. BOEKHOET and OTT DE VRIES. (*Cent. f. Bact.*, ii., vii., p. 187, 1901.)—These authors have returned again to the question whether the ripening of cheese is due to bacteria, as bacteriologists have believed for some time, or in large degree to enzymes, as has been claimed by Russell and Babcock. They had previously shown that it was difficult to get cheese to ripen without the presence of bacteria, and the experiments which they have now conducted have obtained two results. First, they have isolated two very important bacteria from Edam cheese, which they regard as contributing largely to the ripening; secondly, they have experimented with cheese made from milk obtained under special precautions. They attempted first to obtain directly from the cow milk which was sterile, but found this an impossibility. They then adopted the plan of thoroughly washing the animals with a disinfectant solution, and drawing milk under special precautions in closed pail under conditions where the bacterial

contamination was reduced to its minimum. This was done by having a long spout leading from the side of the pail and ending in an open funnel at the same distance from the closed pail. Under these conditions they obtained milk which was not indeed sterile, but had only an exceptionally small number of bacteria. With such milk, which they called aseptic milk, they made cheeses, and found that under these conditions the ripening of the cheese did not occur. Such milk, of course, contained all of the natural enzymes, and differed only from normal milk in lacking bacteria, and they therefore reached the conclusion that, in addition to the action of galactase, the ripening of cheeses is in reality due to the action of bacteria.

Weitere Beiträge zur Kenntniss der naturlichen Milch gerinnung. Kozai. (*Zeit. f. Hyg.*, xxxviii., p. 387, 1901.)—This author, a Japanese, who has previously given useful papers upon milk souring, contributes a further paper upon the same general subject, for the purpose of verifying previous conclusions and explaining the contradictions of others. The important conclusions which he reaches are as follows: First, in spontaneous milk souring there is produced lactic acid, alcohol, acetic acid, and salicylic acid; second, the temperature at which the milk is kept has a great influence upon the kind of fermentation that takes place. In the slow processes of souring there is a more profound decomposition of albuminoids and non-nitrogenous substances than when the process goes on rapidly. In spontaneous milk-souring there are three chief species of bacteria concerned, the most important of which he calls *B. acidi paralactici*, which is the same species as described by several others under different names. A second species is *B. acidi lævolactici*, while a third is a micrococcus. The coli bacillus is also present, and sometimes aids in the process. The second of the three species belongs to the aerogenes group, and it produces left-handed milk acid and a small quantity of alcohol, together with some acetic and salicylic acid. The results thus obtained are in essential agreement with those obtained by students of milk bacteriology in this country. The chief species described by Kozai is apparently identical with the *B. acidi lactici* of Esten, which is the most common cause of milk-souring in America.

Colour Standards for recording the Results of the Nitrate and Indol Tests. C. E. A. Winslow. (Inst. of Techn., Boston, Mass.)—The study of the effect of external conditions upon *B. coli communis* has emphasized the need of some different standard by which the capacity of the bacteria to produce nitrate and indol can be quantitatively measured. Even when the conditions of experiment are rigidly controlled, striking variations sometimes appear, and the law of such variations can be properly studied only when the results are carefully compared with each other.

The use of a colour standard for measuring the reduction of nitrate and the formation of indol obviously suggests itself as simple and more practical than any other.

Up to the point at which a precipitate forms in the nitrite reaction, the depth of colour in both cases may be considered as roughly proportional to the amount of the end product formed by the bacteria in a given time. The problem for the bacteriologist is, then, to select from the numerous schemes of colour values prepared for artistic and educational purposes that one best suited for the matching of the reaction in question.

The most rational system of colour standards which has come to my notice is that prepared by Milton Bradley, of Springfield, Mass., based on pure spectral colours of known wave-length. It is issued in the form of a small booklet, and by cutting out and pasting to a card the colours between red and yellow-orange and their tints, a chart is obtained on which the colour of the indol reaction produced by *B. coli communis* can be readily matched. The hue is read by holding the tube parallel to a white surface and looking through it at right angles, while the matching colour on the card is isolated by a small card with a window cut in it. The tube and card are viewed in strong diffuse daylight.

THE INTERNATIONAL CONGRESS OF HYGIENE AND DEMOGRAPHY.

The Eleventh International Congress of Hygiene and Demography will be held in Brussels, September 2 to 8, 1903, under the patronage of H.M. the King of the Belgians. For particulars apply to the Honorary Secretary, The Royal Institute of Public Health, 19, Bloomsbury Square, W.C.

CHEMICAL NOTES.

OIL OF PEPPERMINT: A NEW ADULTERANT. C. T. BENNETT. (*Chemist and Druggist*, 1903, 591.)—A sample of oil of peppermint which gave abnormal results on analysis was found to contain about 15 per cent. of triacetin, or more probably a mixture of the three acetic esters of glycerol. The physical and chemical characters of the oil were: Specific gravity at 15° C., 0·964; rotation in 100 millimetre tube, − 15°; esters as menthyl acetate, 71·2 per cent.; esters after acetylation, 53·1 per cent.; refractive index at 20° C., 1·4581. On fractional distillation at ordinary pressure a residue was obtained boiling above 240° C., which had a specific gravity of 1·147 and refractive index 1·4450. By distilling a larger quantity of the oil under reduced pressure and subjecting the residue to further fractionation, the presence of a mixture of the acetic esters of glycerol was proved by chemical tests in the final residue so obtained.

NEW REACTIONS OF MORPHINE. C. REICHARD. (*Zeit. anal. Chem.*, 1903, xlii., 95-100.)—The reduction of tungstic, vanadic, titanic, and molybdic acids by morphine is attended by colour reactions, of which that given with molybdic acid has already been described. In the case of vanadic acid (ammonium metavanadate) a green or bluish-green colour is obtained according to the strength of the solution on warming the liquid. The test is best applied by adding sulphuric acid drop by drop to 2 to 3 c.c. of a 0·1 per cent. solution of ammonium vanadate until, on the addition of the last drop, the yellow coloration of vanadic acid just disappears. On now adding a little of the solid morphine salt, and applying heat if necessary, a stable green coloration is obtained. In the case of sodium tungstate a 0·1 per cent. solution is shaken with a few drops of sulphuric or hydrochloric acid, and the morphine added in the solid form or in concentrated solution, a bright blue or violet coloration being produced. The coloration is less stable than that given by vanadic acid, and after a few hours a white deposit of tungstic acid is formed. Stronger solutions of sodium tungstate cannot be used for the

test, since on the addition of a mineral acid the separation of tungstic acid takes place immediately, whilst without the addition of acid there is no reaction. In like manner a cold solution of titanic acid in concentrated sulphuric acid becomes black at the point of contact on adding morphine or its hydrochloride, and on shaking the liquid a blood-red coloration is obtained. This colour disappears on the addition of water.

THE VOLUMETRIC DETERMINATION OF CHLORAL HYDRATE. C. G. HINRICHS. (*Pharm. Journ.*, 1903, 530-532.)—The method described in the British Pharmacopœia (1898) was found to be unreliable when performed under the conditions there laid down, the errors varying from 180 to 200 per cent. of the value determined. Further experiments, however, showed that when carried out as follows good results may be obtained: An accurately weighed amount of the chloral hydrate is dissolved in 50 to 100 c.c. of water, and excess of $\frac{N}{2}$ alkali is run in (15 c.c. per gramme taken). When a turbidity due to separation of chloroform is noted, the solution is stirred until perfectly clear. This usually takes from one to two minutes. The excess of alkali is then titrated back. Each gramme of chloral hydrate should require 12·084 c.c. of $\frac{N}{2}$ alkali.

A DELICATE TEST FOR MOLYBDENUM. L. SPIEGEL AND T. A. MAASS. (*Ber.*, 1903, xxxvi., 512; *Chem. Zeit. Rep.*, 1903, 84.)—One part of phenylhydrazine is dissolved in 4 parts of 50 per cent. acetic acid, and 5 c.c. of this solution are added to 10 c.c. of the liquid under examination. The mixture is boiled for a minute or two, cooled to about 50° C., and extracted, if necessary, with a few drops of ethyl acetate, or preferably chloroform. The non-aqueous liquid then takes up the colouring matter of the impurities in the phenylhydrazine, leaving the watery portion with a red colour if molybdenum compounds are present; this red colour also gradually passing into the non-aqueous liquid. 0·01 milligramme of molybdenum in 10 c.c. of water can be detected with certainty by this test, while it usually shows 0·005 milligramme. The phenylhydrazine should be as colourless as possible, and is best freshly distilled under diminished pressure.

Yeast Extracts. H. Zellner. (*Zeits. Hyg.*, xlii., 461-466; *Chem. Centr.*, 1903, i. [17], 984.)—Yeast extracts under the names of "Siris," "Ovus," and "Wuk," have appeared on the market as substitutes for meat extracts. The three preparations named are obtained from beer yeast. In the preparation of "Ovus," the yeast is steamed and the fluid mass obtained concentrated *in vacuo* till it is of the required consistence. "Ovus" has a faint odour, dissolves in cold water to a turbid liquid, reacts faintly acid, and has a strong saline taste. "Wuk" is obtained from beer yeast suspended in an equal volume of water at 60° to 70° C.; it occurs as a light brown extract, having a faint odour. "Siris" is obtained by the action of ether on yeast, and concentration of the extract obtained. Fresenius obtained the following results by an analysis of "Siris": Water, 29·54 per cent.; ash, 17·29; nitrogenous organic substances, 49·5 (ammonia, 0·3; albumoses, 0·84; substances precipitated by cupric hydroxide, 5·74; and nitrogenous extract substances, 42·6); gum, 3·65; substances extracted by ether, 0·07 per cent.

According to the author, yeast extracts can satisfactorily replace meat extracts so far as flavour and odour are concerned, but they do not contain the valuable extractive matters and stimulants—"the meat bases and meat salts"—of genuine meat extracts.

For the determination of nuclein in the extracts, 10 grammes are dissolved in 100 grammes of water, dilute hydrochloric acid is added gradually, and, after standing for several hours, the precipitate is filtered off. The latter is washed in succession with water acidulated with hydrochloric acid, pure water, hot alcohol, and boiling ether. It is then fused with sodium carbonate and potassium nitrate, and the amount of phosphoric acid in the melt determined.

A Simple and Effectual Method for Keeping Media and Cultures Sealed.—Repeated efforts to devise some means of keeping media and cultures hermetically sealed resulted in the following device: Paraffin stoppers are made from paraffin of the highest melting-point (71° C.). These are kept in a solution containing 50 per cent. of alcohol and 3 per cent. of copper sulphate

until used. The stoppers are of various sizes to fit the various sized test-tubes. To seal the tube a size somewhat larger than the tube is selected, the cotton plug is thoroughly singed and inserted to within ½ inch from the end. The latter is warmed and the stopper inserted. When required for inoculation, the end of the tube is gently warmed and the stopper removed. It may then be held between the fingers during inoculation and replaced, or it may be rejected and placed back into the solution, and the cotton plug alone used. The advantage of this method over rubber caps is, first, in the cheapness, and, second, freedom from moulds, as the small amount of copper sulphate alcohol adhering to the stopper is sufficient to kill the moulds on the upper end of the cotton plug. The advantage over a paraffined plug is that it is less greasy and leaves the cotton plug dry and expansile. Solid media in tubes with paraffined plugs cannot be melted without the paraffin running down into the medium and spoiling it for plate cultures. This is entirely avoided by the use of the stopper.

To make the paraffin stoppers the following method is employed: A strip of ordinary stiff writing-paper is rolled into a tube and inserted into a test-tube. By rotating the paper tube, it is so adjusted as to fit the test-tube snugly. Melted paraffin is then poured into the paper tube, and the whole at once placed in running cold water. When solidified, the walls of the test-tube are slightly warmed, and the inner paper mould removed by a slight rotatory movement. The paper is then easily peeled off from the solid paraffin stick. This is cut up into cylinders of desired lengths, and the latter trimmed into shape with a warm knife. The whole procedure takes but a few minutes.

TREATING SEWAGE SLUDGE FOR THE PRODUCTION OF MANURE. R. ENGLAND, London. (*Eng. Pat.*, 6,021, March 11, 1902.)—The sewage sludge is mixed with concentrated phosphates of the kind which are insoluble in water, but largely or mainly soluble in solutions of ammonium citrate, such as calcined phosphate of alumina and iron; 4 to 5 cwts. of this phosphate in 1 ton of the finished product is a suitable proportion.

ANNUAL MEETING OF THE ROYAL INSTITUTE OF PUBLIC HEALTH.

The Annual Meeting of the Fellows and Members was held in University College on Tuesday, July 21, 1903, at 10 a.m., the President, Professor William R. Smith, M.D., J.P., in the chair.

The notice convening the meeting was read by the Hon. Secretary.

The minutes of the last annual meeting were confirmed.

The Hon. Secretary then read the report of the Council and the balance-sheet, which were unanimously adopted, great satisfaction being expressed at the financial position of The Institute.

The election of the officers of the Institute and of the members of Council was then proceeded with.

The nomination of the Council to these offices, which appeared in the *Journal of State Medicine* for July, were unanimously approved, Mr. C. A. James being elected to a vacancy which had occurred.

A cordial vote of thanks was accorded to the President, the Officers and Council for their able services during the year.

The following were elected Members of The Institute:

As Fellows:

George Aldridge, Civil Surgeon R.A.M. Corps, L.S.A. Lond., 59, Alma Road, Sheerness.

Edwin Thomas Fairweather Birrell, Captain R.A.M. Corps, M.B., Murree, India.

William Wesley Clemesha, Captain I.M.S., M.B., Ch.M. Vict. Univ., D.P.H. Vict. Univ., Post Office, Bombay.

Stafford U. Adye Curran, Lieutenant R.A.M. Corps, M.B., D.P.H., 42, Upper Rathmines, Dublin.

John Francis D'Abreu, L.R.C.P. and S. Edin., D.P.H. Camb., Rugby House, Holyhead Road, Handsworth.

Walter James Waters, Lieutenant R.A.M. Corps, M.R.C.S., Mussouri, India.

Warren Guy Westcott, Surgeon R.N., M.R.C.S., Frampton, Lansdown Road, Bath.

As Member:

Charles Toler Burke, B.E., R.Univ.I., M.I.C.E., 4, Windermere Terrace, Princes Park, Liverpool.

As Associates:

Mary Davy, 91, Great Portland Street, W.

T. Kyffin Freeman, F.S.S., F.G.S., Blairgowrie, Whitehall Park, N.

Frederick Litchfield, F.S.S., 38, Whitehall Park, N.

Mrs. Leonard Marshall, Guardian of St. Mary's, Islington, 26, Canonbury Park, N.

James Cantlie, M.A., M.B.,
Hon. Sec.

University College, Liverpool,
July 21, 1903.

PUBLIC HEALTH MEDICAL APPOINTMENTS.

The following appointments have been announced:

EDWARD TURNER BORN, M.B. Durh., Medical Officer of Health, West Falkland Island.

FREDERICK BUTLER, M.D., District Medical Officer, Beverley, West Australia.

WILLIAM BUTLER, M.B. Glasg., D.P.H., Medical Officer of Health, Willesden.

JAMES HUDSON, M.R.C.S., Port Health Officer, Nelson, New Zealand.

JAMES LANGDON, L.R.C.P. Edin., District Medical Officer, Onslow, West Australia.

EDMUND LAVERY, M.D., Government Medical Officer, Gosford, New South Wales.

WILLIAM REED, M.R.C.S., Medical Officer of Health, Westbury Rural District.

ADAM RICHARDSON, M.B., Medical Officer of Health, Sengast, Natal.

GEORGE TURNER, M.B., D.P.H., Medical Officer of Health, Table Bay Harbour Board, Cape Town.

DIPLOMAS IN PUBLIC HEALTH.

The following have received Diplomas in Public Health:

Aberdeen University.—Kenneth Fraser, M.B., Aberd.; John Halley, M.B., Aberd.; James Macfarlane, M.B., Aberd.; Arthur John Milne, M.B., Aberd.; John Stuart Rose, M.B., Aberd.; James Andrew Simpson, M.B., Aberd.; Robert Alexander Glesson, M.B., Aberd.; William Edward Taylor, M.A., M.B., Aberd.; George Clarke Trotter, M.B., Edin.

Birmingham.—B.Sc. Public Health—Henry Prince Motteram, M.A., M.D.; D.P.H.: Albert Henry Bygott, M.B.; John Ronald Currie, M.B.

Royal College of Physicians and Surgeons, London.—James Candler, M.B., Glasg.; Thomas Divine, M.B., Glasg.; Henry Hewetson, L.R.C.P., Lond.; James Hibbert, M.D., Lond.; Frederick C. James, M.B., Durh.; John Jones, M.D., Lond.; William Knocker, M.B., Lond.: G. J. A. Le Clezio, L.R.C.P.; James G. McNaught, M.D., Captain R.A.M.C.; William Peile, M.D., Dublin; M. H. Raper, M.D., Lond.; M. F. Reaney, M.B., Lond.; R. Rennie, M.B., Glasg.; N. Robson, M.B., Glasg.; C. R. Salisbury, L.R.C.P.; F. W. Sinclair, M.D., Melb.; C. F. Wanhill, L.R.C.P., Captain R.A.M.C.

Victoria University, Manchester.—W. W. Clemesha, M.B.Captain I.M.S.; H. Lawrie, M.D., Edin.; A. Ramsbottom, M.D.; A. B. Dos Remedios, M.D.; F. M. Rodgers, M.B.

Royal College of Physicians and Surgeons, Ireland.—Miss Marie Holst, M.B. (with honours).

REVIEWS, ETC.

A Practical Guide to Disinfection. By M. J. ROSENAU, M.D., with a supplement by FRANCIS J. ALLAN, M.D. 444 pages and 96 illustrations. Messrs Rebman, Ltd., price 10s. 6d. net.

As its title conveys, this book is a practical treatise on disinfection by an eminent member of the United States Army Medical Service, in which a full account is given of every kind of disinfecting apparatus and disinfectant. The work is thoroughly practical and well illustrated. It should be of great use to Sanitary Inspectors and Medical Officers of Health.

Lessons in Disinfection and Sterilization, by F. W. ANDREWES, M.A., M.D. Oxon., L.R.C.P. Lond., D.P.H. Cantab. 222 pages. Messrs. J. and A. Churchill price 3s. net.

Dr. Andrewes deals simply and concisely with the scientific aspects of disinfection. The great charm of this little book is the entire absence of the mass of dry detail which too often encumbers the pages of such works. What the general practitioner requires, a short, concise account of the manner of preventing contagion and of neutralizing contagia, he will find these points here in an excellent form.

Serum Therapy, by Professor R. TANNER HEWLETT, M.D., M.R.C.P., Professor of General Pathology and Bacteriology in King's College, London. 262 pages. Messrs. J. and A. Churchill, price 5s.

This is an admirable account of the present state of our knowledge of this important branch of therapeutics. In each case—and the list is now a long one—Professor Hewlett explains the process of manufacture of the serum, and in the introductory chapter explains lucidly the "side-chain" theory of Ehrlich of the action of antitoxins and toxins. Professor Hewlett carefully discusses the complications and sequelæ of the treatment, and the book has throughout such practicality as makes it a work of real value, apart from its scientific worth.

The Cause and Prevention of Decay in Teeth, by J. SIM WALLACE, M.D., D.Sc., L.D.S., R.C.S. 108 pages. J. and A. Churchill, price 5s.

Dr. Wallace, in this brochure, deals with the causation of caries, which he seems to admit to be on the increase, and which he assigns to the fact that natural foodstuffs are, to a large extent, ridded of their accompanying parts and prepared and consumed in a manner which renders them liable to lodge and undergo acid fermentation in the mouth, while from this same cause and the induced conditions, the micro-organisms of the mouth lodge, multiply, and augment the rapidity and intensity of the acid fermentation. We think that in rejecting so decisively the theory of the influence of heredity as a cause of increased caries, Dr. Wallace neglects or fails to assign their proper value to a very large number of scientifically ascertained facts, which undoubtedly prove the transmissibility of physical defects, as well as the transmission of advantages of structure, which really influences the working of the law of natural selection. Still, Dr. Wallace's theory is interesting, and clearly put.

BOOKS, JOURNALS, REPORTS, ETC., RECEIVED.

THE following books, journals, reports, etc., have been received:

Lessons in Disinfection and Sterilization, by W. H. Andrewes, M.D.
A Practical Guide to Disinfection, by Rosenau and Allan.
Decay in Teeth, by J. Sim Wallace, M.D.
Serum Therapy, by Professor R. T. Hewlett, M.D.
The Lancet; The British Medical Journal; The Sanitary Record; The Surveyor; The Medical Times and Hospital Gazette; The Medical Review; The Pharmaceutical Journal; The Councillor and Guardian; Albany Medical Annals; The Glasgow Medical Journal; Public Health; The Journal of Applied Microscopy; The Journal of the Society of Chemical Industry; Egésyég; Archiv für Hygiene; La Presse Médicale; La Salute Pubblica; The Journal of Tropical Medicine; The Caledonian Medical Journal; The Public Health Engineer; The Journal of the United Service Institution; The Journal of the Association of Military Surgeons of the United States of America; The Journal of the Royal Army Medical Corps; The Municipal Journal; Journal D'Hygiene; Journal of Bacteriology and Climatology.

Also the following official publications:

Report of the Royal Commission on Physical Training (Scotland).

Minute by the Director-General Army Medical Service, on Recruiting Conditions.

Thirty-ninth Annual Report: Sanitary Commissioner for the Government of Bombay.

Annual Report: Sanitary Commissioner with the Government of India.

Report on the Causes and Continuance of Plague in Hong-Kong, by Professor W. R. Simpson, M.D., F.R.C.P.

Scientific Memoirs: Government of India.

Annual Report (1902) on the Sanitary Administration in Burma.

The Action of the Venoms of the Cobra and of the Russell's Viper on the Red Blood Corpuscles and the Blood Plasma.

Report on the Sanitary Administration of the Hyderabad Assigned Districts.

Dr. H. Timbrell Bulstrode's Report to the Local Government Board on the Enteric Fever Outbreak at Winchester.

Dr. S. W. Wheaton's Report to the Local Government Board on Water-Supplies in the Norton Rural District.

Annual Reports of the Medical Officers of Health for Bermondsey, Greenwich, Poplar, Portsmouth, Stepney and Macclesfield.

Also the following:

A Study of the Reticular Supporting Network in Malignant Neoplasm. By P. G. WOOLLEY, B.S., M.D.

A Study of Chronic Infection by the Colon Bacillus. By G. A. CHARLTON, M.D.

Syncytioma Malignum. By J. G. ADAMI, M.D., McGill University.

The Nature of Internal Lesions in Death from Superficial Burns. By J. Mc. CRAE, M.B., McGill University.

The Classification of Internal Tumours. By J. G. ADAMI, M.D.

The Classification of Museum Specimens. By M. E. ABBOTT, M.D.

Primary Carcinomatoid of the Adrenals. By P. G. WOOLLEY, M.D.

Varieties of Colon Isolated from Man. By W. W. FORD, M.D.

Versüche über die Reinigung der Abwässer fur Tempelhof bei Berlin. By Drs. K. THUMM and A. PRITZ KOW.

Letters, Notes, Queries, etc.

Communications respecting Editorial matters should be addressed to "THE EDITOR, JOURNAL OF STATE MEDICINE, 19, Bloomsbury Square, W.C." *Those concerning business matters, non-delivery of the* JOURNAL, *etc., should be addressed to* "THE SECRETARY, The Royal Institute of Public Health, 19, Bloomsbury Square, W.C."

The agents for advertisements appearing in THE JOURNAL OF STATE MEDICINE are Messrs. Van Alexander and Co., 5, York Buildings, Adelphi, W.C., Telephone No. 8503 Central, to whom all communications with reference to advertisements should be addressed.

Communications which have been sent to other journals cannot be received.

Correspondents who wish notice to be taken of their communications should authenticate them with their names—of course not necessarily for publication.

Telephone number of The Royal Institute of Public Health, No. 1614 Central.

THE RIGHT HON. W. WATSON RUTHERFORD, ESQ., M.P.,

Lord Mayor of Liverpool,
Chairman of the Executive Committee of the Liverpool Congress.

Photo by Messrs. Brown, Barnes, and Bell, Liverpool.] [*Frontispiece.*

The Journal of State Medicine.

THE OFFICIAL ORGAN OF
THE ROYAL INSTITUTE OF PUBLIC HEALTH.

VOL. XI.] SEPTEMBER, 1903. [No. 9.

ADDRESS

TO

THE SECTION

ON

SANITATION OF CONGESTED AREAS AND REHOUSING THE DISPOSSESSED.

BY

AUSTIN TAYLOR, Esq., M.P.,
President of the Section.

The Housing Question.

Among the various weighty subjects to be discussed at this Congress, none can exceed in importance the one with which this section has to deal. The Housing Question is one of those problems which is in the initial stage of solution—that stage at which the evils to be met are fairly recognised, but the complete remedies for which have still to be discovered. It will be readily admitted by all who have attended conferences, whether private or public, whose subject for discussion is Housing, that in most cases much time is occupied in depicting the evils to be faced and the difficulties to be encountered, and not quite so much in the suggestion and discussion of practical remedies. Were the subject not one whose evils are so appalling, there would be a certain fascination in the thought that we are at the threshold of this enormous problem, grappling, or attempting to grapple, with a huge social monster, whose outward aspect is mere brick and mortar, but whose interior is dark with the tragic fate of men, women, and, above all, little children. But the evils of insanitary

Act of land outside their boundary for development purposes later on. Much has already been done in the direction of external development by such schemes as those of Mr. Cadbury at Bournville, outside Birmingham, and the Artisans' Dwellings Company outside London, and some municipalities have also moved in this direction. But progress, I think, might be facilitated if municipalities were not obliged by law to earmark such purchases at the time of purchase for specific purposes. If the law were altered so as to permit authorities to vary the use to which such land may be put, it might be bought, held, and used by the municipality as parks, cemeteries, or new suburbs, according as necessity arose. If cottages are erected in the suburbs by municipalities, there appears no reason why any burden should be thrown upon the rates. On the contrary, if the land is bought in time, and money raised on favourable terms, this ought to be avoided even at moderate rentals, which would enable the tenants to receive the benefits of cheap transit now offered to them without a serious rise in rents. I am inclined to think that general powers of this kind might be more extensively used, and special committees constituted for the sole object of watching over the development of the belt of great cities, and in this way much of what we are now suffering from might be avoided in the case of future generations. In this way one committee would have as its sole duty the alleviation of conditions at the centre, while a similar committee would equally have as its sole duty the supervision of the fringe.

These two powers jointly exercised—viz., that of controlling the development of the fringe generally, and the other that of buying land for general purposes (by compulsion if necessary), coupled with a proper system of quick transit, would go far to mitigate a repetition of the evils with which this section is concerned. For the sanitation of a congested area, valuable though it be, is not in the true sense a solution of the housing problem. Congestion can only be effectively met by its opposite expansion. And expansion of a satisfactory character can, I think, only be brought about by some such policy as I have ventured to indicate.

In its absence the sanitation of congested areas means, then,

nothing more than the rearrangement of streets, the improvement or demolition of insanitary property, good drainage facilities and sanitary appliances, coupled as a rule with a smaller percentage of inhabitants to be housed on the area dealt with. It is with the percentage who in most cases must be moved on if overcrowding is to be avoided that I have been concerned in previous paragraphs, and for dealing with whom a general expansion of the city seems the only resource.

The drastic weapon of demolition is in many cases the only remedy for what are called congested districts—the only weapon, that is, which will effectively substitute healthy streets and dwellings for narrow alleys and sunless courts. It will cure congestion in the particular area in its worse forms, because the entrance of the municipality as house-owner means closer supervision and a more careful regard to the use or abuse to which the houses themselves are put. But much, as you all know, can be done by the rehabilitation of old property in isolated cases where a scheme is not desirable. Closing orders under Part II. are often most effective in bringing about necessary improvements at a minimum of cost. Sometimes an owner can be compelled in this way to remove a certain number of houses in order to secure proper ventilation and light for those which remain, and can also be induced to put these latter in a state of thorough repair. In this way houses not really hopeless can be saved to do good work and relieve the municipality from the stigma of appearing to pull down for the mere pleasure of destruction.

Again, in many cities special powers of a local character exist for dealing with insanitary property on lines advantageous to the particular locality, and by methods more expeditious and less costly than those afforded by the Act of 1890.

In all cases it is desirable for every municipality which has to deal with congested districts to map out the whole of its work in advance, so as to proceed on a connected system over ten or twenty years. There is no doubt that in every city different parts even of unhealthy districts lend themselves to different treatment. Enormous waste both of time and money arises in many cases through lack of some settled plan. Street improve-

ments are not infrequently made by one committee merely as street improvements without reference to possible action by another committee which could include them as part of an unhealthy area under Parts I. or II. A map of the whole city, with all insanitary property clearly marked out upon it, which could be consulted by all committees concerned with city improvements, would tend to the evolution of a settled plan, and any kind of insanitary property could be earmarked in advance, to be dealt with under different Acts according as the circumstances of each locality might prescribe.

Provision for the housing of the dispossessed is insisted upon by the Local Government Board, but in practice the former tenants of slums do not, as a rule, occupy the new houses erected. In the first place, because the rents are too high, and, secondly, because demolition takes place frequently before the new buildings are erected. It appears to me a matter of great importance that slum dwellers, when not a criminal class, should be induced by low-rented accommodation (provided in advance) to transfer themselves into the new houses. This is the plan successfully adopted in this great city, and it is one which gives a sense of solid achievement that cannot exist when the slum dwellers are dispersed to create fresh slums, and their places are taken by artisans who could well afford to live further out. Those who have lived in slums have frequently been compelled to do so to be near their work. They cannot afford to travel far, and I hold strongly that the first duty of a municipality is not to the artisan, but to the poorest poor, who are necessarily ejected from their homes in the general interest of the community. I do not think it is right that they should be altogether abandoned to the process called levelling-up. A certain percentage will always, doubtless, prefer to move on, but if houses are provided in advance a large percentage will also avail themselves of them if the rents are reasonable. Under municipal supervision and in brighter and cleaner surroundings, these will stand a fair chance of improvement, and in any case their children will feel the benefit.

I can anticipate objections with regard to cost and rentals, but

it is sufficient to say that in Liverpool these have not been insuperable, though the rents charged fail to provide a sinking-fund. But I have no doubt that Mr. Turton, in the paper he has promised, will fully elucidate all these points to your satisfaction.

The great cost involved in schemes, under Part I., serves with many municipalities as a deterrent to action. I am inclined to think that, excluding London, where the land is so highly valued, areas which have a very large percentage of real slum property need not cost quite so much as some people imagine, though on this point I speak with great hesitation. Very considerable powers of pressure can be brought to bear in cases of hopelessly insanitary property, which, under the Purchase Clauses of Part I., are only entitled on arbitration to the value of the land and of the materials of the buildings thereon. Of course, if under any scheme large quantities of property not hopelessly insanitary are included, the cost must go up. But this only emphasizes the necessity I previously referred to of mapping out in advance the work to be done. Where the value of the land is high, of course, no abatement for the insanitary condition of property upon it will prevent a costly scheme, and the same equally applies where many licensed premises exist and are got rid of, as in my judgment they ought to be if the condition of the tenants is to improve.

I cannot quit either branch of the subject with which this section has to deal without a few words on proposed changes in the law. They may be grouped under such headings as Simplification of Procedure, More Favourable Financial Facilities, Modification of Building Regulations, and the Rating of Vacant Sites on their Capital Value.

It is felt by many that closing orders require to be made more direct and effective in their operation, particularly where demolition is called for; that inquiries under Parts I. and II. should be reduced in number, and provisional orders should be issued by the Local Government Board without the need of Parliamentary sanction. For all these changes a great deal can be urged.

More important still are the changes advocated in the period of repayment for housing loans. I earnestly trust that the

recommendation of the Select Committee of the House of Commons on this subject, for an extension of the term to eighty years for buildings and the housing value of the land, will be embodied in law. On two typical blocks in Liverpool I have satisfied myself that the saving which this would bring about, as against the present terms of thirty and forty years, would amount to 6d. per room per week. Such a saving would enable Liverpool to approximate much nearer than it can to-day to the ideal standard of 1s. rent per room per week.

As to the action of the building regulations imposed by the Local Government Board on other parts of the country, I cannot speak with confidence, and will therefore leave this to be dealt with by those who have had individual experience of them. In Liverpool I do not think they have given much trouble.

The rating of vacant sites on their capital value is a limited part of the general programme for the assessment and rating of sites generally, and the part of that programme upon which opinion is least divided. On this difficult question I do not intend to occupy your time, except to say that the principle, to my mind, is a sound one if only some practical and fairly equitable means can be devised for giving effect to it.

In concluding this brief address, which I have endeavoured to make severely practical, allow me to bid all those who are interested in Housing a hearty welcome to the city of Liverpool. The efforts here made to solve this problem will, I know, interest and encourage you all in this great and benevolent work, and I trust that our mutual discussions may bear practical fruit in stimulating us all to still greater and still better-directed effort.

HONORARY FELLOWS.

His Majesty the King of the Belgians, K.G., and His Highness the Khedive of Egypt, G.C.B., have been elected Honorary Fellows of The Royal Institute of Public Health.

THE GOSPEL OF HEALTH.

BEING A SERMON PREACHED BEFORE THE CONGRESS IN THE SEFTON PARK PRESBYTERIAN CHURCH

BY THE

REV. JOHN WATSON, D.D.

"And the inhabitant shall not say, I am sick: the people that dwell therein shall be forgiven their iniquity."—ISA. xxxiii. 24.

WERE any excuse needed for preaching on the Gospel of Health, it could be found not only in the influential and beneficent Congress which has just been meeting in our city, but also in the inclusion of this subject within the scope of our religion. No one can read our sacred Book, either in the Old or New Testament, without being impressed by the broad and sane view which the Bible takes of human nature. Its writers recognise that man is both soul and body, and that the perfect man is one in whom a sound soul inhabits a sound body. While there is a proportion in all things—and the Bible justly places the spiritual above the material—yet nowhere is any sanction given to that superstitious asceticism which proposes to elevate the spiritual by the abuse of the material, or to that other-worldliness which, in the contemplation of a perfect environment to come, is indifferent to the defective environment here. The Jewish Church has the unique credit of embracing elaborate rules of sanitation within its solemn legislation, and according to the day nothing, I suppose, could be wiser than the directions for the cleanliness of camps, for the burial of dead outside cities, for the selection of sound food, for the abundant use of water, and for the enforcement of self-control in every relation of life. The Jewish law of health has anticipated many teachings of modern science, and has secured that its people, not only when they lived in their own country, with an average of 300 inhabitants to the square mile, but even while they were living in the crowded and filthy ghettos to which oppression condemned them in Christian cities, were the healthiest of civilized nations, as they are also one of the most virile and enduring.

There is a vague idea in many minds that when one passes from the Old Testament to the New he rises into an atmosphere where the care of the body and the affairs of this life are matters of indifference, if not of contempt, and that there is no place for anything but the spiritual in the teaching of our Master. It is surely forgotten, in this ghostly idea of Christianity, that our Lord's works ran side by side with our Lord's words, and that, if He was the chief of prophets, He was also the most successful of physicians. Without turning aside to discuss the miraculous element in the life of Jesus, or the accuracy of all the historical documents, one may safely conclude that Jesus performed by one method or another astonishing cures in certain diseases, and that all His life He fought against disease and beat back death. There was in Him a spring of vitality which not only sustained Him during all His labour, and saved Him from the debilitating fever which devastated the district in which He worked, but flowed through some subtle magnetic law into the wasted bodies and failing hearts of His fellow-men. Personally, it is my belief that many of the healing miracles of Christ can be explained by the action of those laws of mental suggestion which are now coming within the range of science; but, apart from all such speculation, it is a fact which stares us in the face, and is pregnant with meaning, that the Founder of Christianity and the Saviour of mankind was not only a teacher, but also a doctor. Nor was He satisfied with His work till He had healed His patients both in soul and body. Our religion gives a pledge of its grasp of circumstances when it recognises the underlying connection between the moral and the physical, describing the ideal city as one wherein the inhabitant shall not say, "I am sick," [and] "the people that dwell therein shall be forgiven their iniquity"; and serving a Lord who, when He healed disease, was accustomed to say, "Sin no more, lest a worse thing come unto thee."

One cannot recall the extraordinary immunity of the Jews from the recurring epidemics of the Middle Ages without a profound regret, and something like shame, that the Christian Church of that period was so indifferent to the obligations of health and

to her own function as the teacher of bodily as well as of spiritual soundness. Her authority was then absolute, for Kings and people trembled before her; and yet in the twelfth century there were fifteen widespread epidemics, in the thirteenth century twenty epidemics, and in the early part of the fourteenth century eight epidemics. In the year 1348 the Black Death passed over Europe, destroying one-fourth of the entire population, and in London alone 100,000 died. In 1485 the sweating sickness broke out, which was largely due, first to the insanitary condition of the towns, and next to the intemperate habits of the people, and, according to one writer, was especially fatal to "idle persons, good ale-drinkers, and tavern-haunters." Why did the Christian Church, which was so ready to hurl multitudes in foolish crusades against the Saracen, not call them to a crusade far more in keeping with the spirit of her Master—not to take men's lives, but to save them; not to rescue His empty tomb, but to keep many a tomb from being filled; not to fight for dogma, but to fight against filth, disease, and suffering? How great was her opportunity, with her immense influence over men! How solemn was her call to fight that disease which is the twin brother of sin! how suggestive her silence, how signal her failure! It was the Fire of London in 1666, and not any influence of the Church, which taught people to appreciate in some slight fashion the danger of uncleanness and the blessing of city sanitation. Within quite recent days the Church was so indifferent to the double mission bequeathed her by her Lord, and so densely unconscious of the connection between soul and body, that it was proposed to meet the invasion of cholera by no other means than prayer, till a wise and outspoken statesman suggested that, instead of a day of humiliation, it would be better to have a day of sanitation. One is thankful to believe Christian folk are growing wiser, and that—to avail myself of a saying of Sir Oliver Lodge—they are recognising that "Prayer and no drugs are as absurd as drugs and no prayer."

One is inclined to lay great stress upon the Church as a teacher of health, because, as a wise writer on hygiene has truly said, people cannot be dragooned into cleanliness or be made virtuous

by police regulations. "The people," he goes on to say, "must be taught that good conduct, personal cleanliness, and the avoidance of all excesses, are the first principles of health preservation; that mental and physical training must go hand-in-hand in the rearing and guidance of youth; and that morality does not consist so much in a blind observance of the formulæ of empty creeds as in a hearty submission to precepts of health." And, regarding the subject from the ethical point of view, Mr. Spencer has truly said:

"The preservation of health is a duty. Few men seem conscious that there is such a thing as physical morality. Men's habitual words and acts imply the idea that they are at liberty to treat their bodies as they please. Disorders entailed by disobedience to Nature's dictates they regard simply as grievances, not as the effect of a conduct more or less flagitious. Though the evil consequences inflicted upon their descendants and on future generations are often as great as those caused by crime, yet they do not think themselves in any way criminal. It is true that in the case of drunkenness the viciousness of this bodily transgression is recognised, but none appear to infer that, if this bodily trangression is vicious, so, too, is every bodily transgression. The fact is that breaches of the law are physical sins."

In the social reformation upon which we have entered, which must not cease till every home in England be healthy and be inhabited by a healthy family, the Church of Christ should be the ally of local government and sanitary science. Religion has suffered in the past because many of her teachers were men in unsound health, and therefore took distorted views, and because masses of her people were living in unhealthy conditions, where a full and glad Christianity could not be realized. Disease, poverty, ignorance, and vice, are all tied up together in one tangle, and it is hardly possible for men to be religious in unclean homes and with unclean habits. One does not say that a person may not be a saint although he be diseased; for, indeed, from St. Paul downwards, many a man, alike in religion, science, and literature, who has left the world better, has had to fight against every bodily disadvantage. But the ideal state still remains—a healthy

soul in a healthy body. One may not say that every man who washes himself is of necessity a good man, and one remembers, if all stories be true, that some saints had no great love for soap and water; but, at the same time, it may well be preached that dirt is an enemy to all decent living, and that cleanliness is at least halfway to godliness.

An excellent man said to me recently: "Isn't it more important to save men from sin than from typhoid?" And he was evidently concerned lest the Church should miss the mark by lending her aid to a physical reformation. No doubt the disease of the soul is worse than disease of the body, just as a wound in the heart is more serious than an ulcer on a limb; but there is no need of this futile and exasperating comparison. When it is calculated that there are 120,000 cases of preventable deaths in England and Wales, according to a very careful statist, surely this fact should lie, not only on the minds of City Councils and Health Congresses, but also on the conscience of the Church. This huge army of victims, greater than the hecatombs slain in the most fatal war, means so much pain, so much sorrow, so many widows, so many orphans, all of which is preventable. If the Church makes a charge of the widow and the fatherless, and if pure and undefiled religion has been defined as their visitation, much more should the Church strain every nerve to prevent women being made widows, and children being reduced to orphanhood. Besides, beyond this huge number who have died, how many are suffering every day from preventable diseases, which means the trying of men's faith, the impoverishing of men's homes, the reduction of family strength, and also the hindrance of religion! It is a question whether the Church at home should embark directly upon medical work, as she does abroad, and personally I should think that it had better be left to other bodies, municipal and social; but can there be any question that the Church should impress upon her people the laws of health, should send forth her sons to labour in the physical reformation, and by her sympathy should strengthen the hands of all who are fighting disease and labouring for the health of the people?

It is encouraging to note the success of sanitary science during

recent years, and especially as citizens of Liverpool we ought to be grateful for the intelligent effort of our municipal and medical authorities, by which the death-rate has been reduced from 26·6 in 1884 to 21·6 in 1901; and in that connection it is interesting to observe that the deaths from typhus, a disease simply of dirt, has decreased from 77 in 1884 to 14 in 1901. The magnificent handbook compiled for the Health Congress, and containing a complete view of what may be called the means of physical and mental salvation in Liverpool, is one of which every citizen should be proud, and for which we are most grateful to Dr. Hope, our Medical Officer of Health. Much, however, remains to be done, and Liverpool men should study with searching of heart the comparative death-rate of the cities of England, in which Liverpool occupies a by no means creditable place. It is not wonderful that the town of Croydon should have only a death-rate of 12·8, for it is very happily situated, is inhabited by well-to-do people, and has a population of only 14·9 to the acre; but it puzzles a mere layman to know why London, with its enormous population, its large docks, its hordes of low-class foreigners, and its population of 60·7 to the acre, which is the highest in England, should have a death-rate of only 17·5, while we, a city of less than one-seventh the size, with a population of 51·8 to the acre, should have a death-rate of 21·6. Bristol is a seaport, and the death-rate of Bristol is 15·9; Cardiff is a seaport, and the death-rate is 15·7; Hull is a seaport, and the death-rate is 18·5. Only three towns—Dublin, Manchester, and Newcastle-on-Tyne—in 1901, exceeded our death-rate, while Salford equalled us. Upon the whole, the reason of this high death-rate in comparison with other cities must be found in the congestion of the people and the insanitary buildings, and the lesson of those statistics is that we ought to gird up our loins, and, under the guidance of sanitary science, spare neither money nor trouble to lift this cloud of physical disgrace from our city, and give the poorest of our people as good a chance of life as they would have in any other seaport of England.

No public body can act much in advance of public opinion, and it is surely for the Church to create a sound atmosphere on this

subject. A very large proportion of the ratepayers, and practically all the leaders of opinion, are within the reach of her voice; and if it be right that on eleven Sundays they be instructed how to save their own souls, it cannot be wrong that on the twelfth Sunday they be exhorted to save the bodies of their less-fortunate fellow-citizens. Especially should the Church plead for flowers and trees, and open spaces throughout the city, where children can play and see a little of Nature, and old folk and young breathe fresh air. The Church also should prepare the people in large cities for a more sanitary disposal of the bodies of the dead, and teach them that there is no Christian objection to cremation. Although the day may be long of coming, one can imagine few sanitary measures more needful and more beneficent than the abolition of cemeteries in the midst of cities. One also wonders whether the Church, with her unique means of influencing people regarding duty and saving them from foolish delusions, has used her influence to enforce and defend the law of compulsory vaccination. It is pitiable, and makes one ashamed of English Government, that a handful of faddists working on the minds of ignorant people should be able to threaten the country once more with a plague of small-pox, or to prevent that loathsome disease from being stamped out in the land.

If it be a great thing, for which a man may well lay down his life, to be the saviour of his brother's soul, it is no slight thing, for which he may well be at great pains, to save his brother's body, and if gallant men have died willingly on the battlefield or on the scaffold to win the political freedom of their country, Church and State may well unite to secure the health of the freemen who dwell therein, for it availeth little for people to have votes if they have not homes. Two ideal cities have been imagined in literature —one inside the Bible, the other outside—and the two imaginations largely agree. The chief city of Utopia, namely, Amaurote, is built on the side of a hill, and by the bank of a river, and it has also another river running through it. The streets are "very commodious and handsome," the houses be "of faire and gorgious building, and every house hath its own garden, wherein are all maner of fruite herbes and flowres. . . And it mae seme that

the first founder of the citie mynded nothing so much as these gardens." The second city is New Jerusalem, which was seen in a vision by a Jewish patriot, with a "pure river of water of life, clear as crystal . . . [and] in the midst of the street of it, and on either side of the river, was there the tree of life; and in the city" "there shall be no more death, neither sorrow, nor crying, neither shall there be any more pain: for the former things are passed away." And no Christian man should cease from prayer or work till we have realized Utopia in England—

"Till we have built Jerusalem
In England's green and pleasant land."

THE HARBEN LECTURES, 1903.

THE Harben Lectures for 1903 will be given by Professor Ferdinand Hueppe, M.D., of the University of Prague, by permission of the Council, in the Lecture Theatre of King's College, University of London, at 5 p.m., on the following dates:

Thursday, October 8. Subject: The Etiology of Infectious Diseases from the Standpoint of Natural Science.

Monday, October 12. Subject: Hygienic Lessons to be derived from the Serum Treatment.

Thursday, October 15. Subject: Tuberculosis.

The attendance of the Fellows and Members of The Royal Institute is particularly requested.

Professor Ferdinand Hueppe, M.D., of the University of Prague, who has been appointed The Harben Lecturer for 1903, has had a wide and varied experience of the practical aspects of hygiene, and he is the author of a series of pamphlets on almost every subject connected with the science of prophylactic medicine. He is a lecturer of tried power, having travelled in France, Russia, Italy, Greece, Turkey, and Scandinavia, and is a corresponding member of the several learned societies of those countries.

E. W. HOPE, M.D., D.Sc.,
Medical Officer of Health for the City of Liverpool,
Honorary Secretary to the Liverpool Congress.

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INFECTIOUS HOSPITALS.*

BY

W. J. SIMPSON, M.D., F.R.C.P.,

Professor of Hygiene in King's College, London.

I SHALL preface my observations by the remark that the infectious hospitals I am acquainted with are models of comfort and administration, and that the criticisms I may have occasion to offer are not directed to any special hospital or to its management, but to a system which is not in harmony with our modern knowledge of the infectious material of infectious diseases. I may further state, in order that I shall not be misunderstood, that I am not an opponent of isolation hospitals.

There are several standpoints from which infectious hospitals may be viewed, but I propose to deal to-day with their construction, and the relation which this bears to their efficiency. The type has been copied from the plan usually adopted in the building of general hospitals, and I wish to place the question before this meeting whether it is the most suitable type for infectious disease. I hold the opinion that it is not; indeed, I have certain doubts in my mind as to whether the general hospitals of the present day are the best adapted for the comfort and welfare of the patient. There is no objection to the aggregation of patients in a common building. This is a matter of convenience, and as long as the building is well ventilated and well arranged for administrative purposes, there is nothing against it; but the aggregation of patients in a building is on a different footing from their aggregation in wards, in each of which there are from twelve to twenty beds. Nothing, perhaps, appeals more to one at the time of one's visit to a hospital than the large, pleasant, cheerful, tidy, clean, and comfortable wards, with their double row of beds occupied with patients. This aspect of the large ward system is so striking that it throws into the background others which are also important; and it seldom occurs to one to ask if the system is the best adapted for the greatest comfort and welfare of the patient. It

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* Paper read at the Liverpool Congress of The Royal Institute of Public Health.

would seem at first sight to have no disadvantages, but when attention is directed to this communal life of the sick, it becomes evident that there are great drawbacks to it. For example, to the sensitive the ordeal of being in a common ward with a dozen or twenty other patients must be great and at times distressing. Again, the presence in the ward of someone seriously ill, or in great pain, or near the point of death, is not calculated to lessen that distress, or to be conducive to composure of mind and the conditions essential for a speedy recovery. The value of the mental factor in the treatment of disease is appreciated by the medical profession, and manifests itself in the adornment of the wards, and in the kindness and sympathy which surrounds the patients; but it appears to me that one of the most important mental depressants is overlooked, and it is the location of the patient in a common ward. The defects of the general ward are, first, the want of privacy, and, secondly, the impossibility of placing the patient under the best mental conditions for recovery. These drawbacks to a large ward system will, I believe, lead to a great change in the new hospitals of the twentieth century, in which common wards will be abolished for the treatment of the sick, and be only retained for recreation and meals of convalescents.

For infectious hospitals the objections to a large ward system are even greater. Dealing, as these hospitals do, with scarlet fever, diphtheria, small-pox, and other communicable diseases, there is apt to be in a common ward, filled with patients suffering from the same disease, infectious material of varying degrees of virulence, which is not to the advantage of those who are admitted with a very mild variety. Then there are a number of cases in which two separate infectious diseases are co-existent at the time of admission, or a day or two after admission. These amount to nearly 3 per cent. of the cases in the Metropolitan Asylums Board hospitals, and when placed in a common ward there is the risk, even with the greatest care, of the second disease spreading. The combination most frequent is that of scarlet fever and diphtheria, reaching to nearly 2 per cent.; the next combination—but coming a bad second—is scarlet fever and chicken-pox, or diphtheria and chicken-pox.

As might be expected, owing to this unavoidable introduction of concurrent diseases, we find that these diseases form the chief complications of an infectious type in the scarlet fever and diphtheria wards. Setting aside chicken-pox, and only dealing with scarlet fever and diphtheria, the following table, compiled from the annual reports of the Metropolitan Asylums Board, gives the ratio in which these two diseases co-existed on or soon after admission, and the ratio of incidence of these diseases as complications among the patients in the hospitals:

	1896.	1897.	1898.	1899.	1900.	1901.
No. of cases admitted:						
Scarlet fever - -	15,176	15,241	12,771	13,274	10,700	14,143
Diphtheria - -	4,296	5,493	6,326	8,310	8,238	7,690
Rate in which scarlet fever and diphtheria were co-existent on admission	1·5	1·3	1·2	1·0	1·1	0·7
Rate of incidence on scarlet fever cases of diphtheria complications in hospital - - -	4·6	5·2	5·1	5·2	3·8	2·7
Rate of incidence on diphtheria cases of scarlet fever complications in hospital - - -	8·9	6·9	4·8	4·3	4·7	3·1

The table indicates that it is not merely a question of the occurrence of post-scarlatinal diphtheria in infectious hospitals, which is a complication that has attracted a good deal of attention and discussion, but it is also a question of the occurrence of post-diphtherial scarlet fever. I do not think that anyone can compare these figures without being impressed with the fact that in the common ward a child entering with an uncomplicated scarlet fever or diphtheria runs the risk—it may be a small one, but still it is a risk—of becoming infected with diphtheria or scarlet fever. It says much for the administration that it is not more frequent. In a common ward one might say that cases of

this kind are almost inevitable; but, though inevitable with the present system, can they not be prevented by some other system?

Some very instructive tables are given annually in the medical supplement of the Metropolitan Asylums Board report, in which the post-scarlatinal diphtheria is tabulated according to ward, date of direct onset of scarlet fever, date of onset of diphtheria, and the days after admission. A close examination of these shows that a ward will sometimes be a year without any post-scarlatinal diphtheria, whilst another year it will have from 30 to 50 per cent. of all the cases in the hospital. Some wards have cases nearly every month, while in others there is a sudden outburst, and then it stops. It is evident also that the post-scarlatinal diphtheria, after the patient has been in hospital for a fortnight or three weeks at the most, is caused by infectious material accidentally introduced into the wards.

The common ward and the general congregation of convalescents on the barrack system are, I believe, the chief causes of return cases. In an infected ward there are obvious facilities for a patient, who under ordinary circumstances would be free of infection, becoming re-infected, especially if there is some discharge to which that infection can attach itself. That this infection is engrafted more or less accidentally I think is shown by the fact that there are large numbers of children sent out of hospital with discharges from ears and nose, and yet they do not produce return cases, indicating that the discharge *per se* is not infectious in them; also by the fact that the infection of a diphtheria case introduced into a scarlet fever ward soon becomes attached to some of the patients, particularly those with discharges, and, without necessarily attacking them with diphtheria, causes them to become the carriers of infection. Further, when the diphtheria infection has been conveyed to several patients in a common ward, the removal of the patients with diphtheria bacilli on them to one side of the room, their attendance by special nurses, and the carrying out of special precautions as to disinfection of instruments and utensils, have in some instances been sufficient to prevent its further spread. Further, when a patient

with scarlet fever is isolated, as at the Pasteur Institute in Paris, from the commencement of the illness, and has an otitis as a complication, examination shows that there is nothing but streptococci of the ordinary type, and there is no hesitation in sending the patient home, and there are no return cases. Return cases are, moreover, rare when scarlet fever is treated at home, and the children of the family are not allowed to return until the illness is over.

It is because I hold these views in regard to accidental infection in common wards—or, in other words, the existence of hospitalism as regards infectious wards—that I am of opinion that no length of detention in an infectious ward will have any effect on the reduction of return cases. An exception to this may occur when the detention brings the patient into that period or season of the year when scarlet fever, like other infectious diseases, is at its lowest degree of infective activity, but this does not affect the general rule.

As regards length of detention, I am glad to see that the Metropolitan Asylums Board have acted on my recommendation and reduced the average stay in hospital by one week. This has been accomplished without any corresponding increase in return cases. A week's reduction possesses a very important economical value in that it saves the building of a new hospital and its administration. A new hospital costs at least £250,000, and its maintenance and administration somewhere near £35,000. The present average is for scarlet fever patients 59 days against 66. I believe it can with perfect safety and benefit to the patients be reduced another week.

This reduction of length of stay in hospital does not, however, lessen or remove the disadvantages belonging to the system I have been dealing with. Though it does not increase, it does not reduce to any extent the return cases, and, after all, the prevention of return cases is more important than the economical aspect, though I believe both can go well together.

The risk which a patient admitted with a mild attack encounters by being placed in the same ward with others who may be suffering from a more virulent or acute form of the disease still

remains. The system, moreover, provides no isolation for those cases that are doubtful, and which require several days' development before the disease can be precisely diagnosed, nor does it provide against the chance of the admission of two co-existent diseases into the same ward, and the consequent post-scarlatinal diphtheria and post-diphtherial scarlet fever which ensue.

These and other considerations, and the search for a remedy, have for long exercised my mind as to whether the large ward system could not be abolished or modified in such a manner as to remove the objections which I have mentioned. Space, difficulty of administration, and cost have always appeared to be insuperable obstacles in the way. But recently I have seen hospitals which go far to solve these difficulties. The first were in China, built by Chinamen in Chinese fashion, each patient having a cubicle of his own. The idea was good and well carried out, though from sanitary and other points of view the arrangements were extremely defective. The next was in Japan, at the new hospital in Tokio, where I may remark in passing that the operating theatre and its equipment for sterilizing instruments, etc., and its general arrangements in regard to cleanliness and antisepticism are equal to, if not superior to, most of the operating theatres I have seen elsewhere. The general hospital was the pink of cleanliness, and though there were some large wards, the majority in the block which I went over were arranged in small wards. The arrangements impressed me with the practicability of a hospital being built on the cubicle system.

Later on a visit to Paris gave me the opportunity of inspecting the Pasteur Hospital, built in connection with the Pasteur Institute. Here is a hospital built wholly on the cubicle system, excepting two wards, which are found to be unsuitable, and which will be subdivided. Originally intended for diphtheria, the hospital has gradually admitted every kind of infectious disease, so that there is often on one floor of a block a different disease in adjoining cubicles. For instance, at the time of my visit there was in one cubicle diphtheria, in the next measles, in the next scarlet fever, in the next chicken-pox, in the next scarlet fever, in the next scarlet fever, and in the next pneumonia,

and so it went on. All these patients are attended by the same nurse, and yet it has never happened that the disease of one patient is conveyed to another patient. There is never any diphtheria after scarlet fever, except in those rare cases when the patient is admitted with the two diseases co-existent, and then, as a matter of fact, the diseases run concurrently. In the old hospital system in Paris there is plenty of post-scarlatinal diphtheria. There is never any measles after diphtheria, though it is not uncommon in the other hospitals.

Cases of diphtheria are kept in hospital from fifteen to twenty-one days. The longer period is more to watch for accidents from the use of the serum, such as eruptions, fever, and pain in the joints, than for fear of their being infective.

The only general precaution on admission is that every child of less than five years of age is injected with 10 c.c. of diphtheritic serum.

Scarlet fever cases are not kept in hospital longer than fifty days if free of fever; the general rule being forty days. The proportion of rhinitis and otorrhœa is considerably less than in other hospitals, and when these complications occur the patients are detained no longer than the ordinary cases, the nose and ears being washed with oxygenated water, and local applications being made.

The hospital is built on the ordinary pavilion plan, with a small veranda on each side on each story, but instead of the long ward containing two rows of beds, ten or twelve in number on each side, separated by the central portion of the ward, it contains the same number of cubicles separated by a central passage. Each cubicle has its outside window, opening into the veranda, and its outside wall, which is the wall of the block. Its other three walls, two of which separate it from the adjoining cubicles, and the third from the central passage, are so constructed that the masonry part is only 4 to 5 feet in height, and the rest to the ceiling consists of glass. The door leading into the passage has the lower portion of wood and the upper of glass. The result is a series of well-lighted, self-contained rooms, with a well-lighted central passage, and so arranged that, while admitting of a certain

amount of privacy, they are all under the direct supervision of the nurses on duty. Each cellule is provided with its own ventilation and warming, warm air being admitted near the floor, and the vitiated air being removed near the ceiling. It is also provided with hot and cold water arrangements. There is no furniture in the room except a small table, chair, and the bed and requisites for the patient. When a bath is given, a bath on rollers is brought into the cellule and filled from the taps.

The floor of each cellule is tiled, and cleaned twice a day with water containing 10 per cent. of hypochlorite of soda. Cups, spoons, etc., used by the patient are collected at certain times of the day by a sister, who uses an antiseptic towel to take them up with, and places them in a metal receptacle carried by another sister. They are immediately taken to a special room on each floor, where they are placed into an apparatus in which they are boiled and disinfected. In the admission room the patient is stripped, wrapped in a covering, and placed in a specially constructed bed, which is then wheeled into the cubicle. The patient remains in this bed until bathed and removed to the ordinary bed in the cubicle.

When about to be discharged, the patient is taken into the bathroom, one door of which leads from the central passage, the other into the veranda outside. The clothes worn in the cubicle are taken off in the bathroom and placed in a metallic utensil. A bath is then given, and the disinfected clothes in which the patient arrived at the hospital are put on. The patient then leaves by the door leading into the veranda, and joins the relatives or friends waiting outside. The bath and floor of the bathrooms are washed and disinfected with cressyl every time they are used.

The bedding is disinfected in a steam disinfectant. Frequent disinfection tends to destroy the mattresses, and in order to avoid this a Clayton apparatus is being erected, by which the bedding, etc., shall be disinfected by the Clayton gas, which is a mixture of SO_2 and SO_3, and is destructive to the ordinary nonsporing organisms. The most striking features of the hospital are the excellent arrangements and the remarkable attention to detail in

regard to the disinfection of everything. The nurse uses a special costume in each cubicle, and is most careful to disinfect her hands. It appears to me that in future hospitals for infectious disease the cubicle system is the one to be adopted. I do not advocate the absence of classification of cases which characterizes the Pasteur Hospital, but I do advocate that a patient sent for treatment to an infectious hospital shall be isolated, and not segregated with others, to the disadvantage of both. And in regard to the existing hospitals, many wards could with advantage be converted into the cubicle system. Glass is now made as strong as ordinary walls, and there would be no difficulty in having the lower part opaque while the upper part was transparent for purposes of administration and light. One set of cubicles could be used for the admission of patients until it was determined whether two diseases co-existed. In the event of co-existent diseases they could be treated in the cubicle until well, while in the event of it turning out to be the disease for which it was sent to hospital the patient could be drafted after a certain time into a suitable common ward where the cases were classified. Another set of cubicles would provide isolation rooms for all patients suffering from discharges, thus preventing any possibility of spreading to other cases, and avoiding the danger of remaining in a ward in which infectious material could be engrafted on the discharges. In this manner some of the advantages of the cubicle system could be secured in hospitals already built. I am convinced that it is in this direction that changes in the construction of infectious hospitals should be made, and I hope the result of this discussion will be to draw attention to its practicability and necessity.

REHOUSING THE POOR ON THE OUTSKIRTS OF LARGE CITIES.

BY

JAMES NIVEN, M.A., M.B.,

Medical Officer of Health for the City of Manchester.

THE problem of housing the working classes has more than one side to it. In most of our large towns there are areas which are essentially unhealthy, in which the houses are built too near together, in such a manner as to prevent the free movement of air around and through them, in which there is insufficient access of the light remaining unintercepted by smoke, and in which the houses have fallen into decay. To this may be added a condition common to the older houses, that damp-proof courses have not been provided, so that the damp rises in the walls.

These areas come to be inhabited by the poorest portion of the population, and are frequently in a dirty and neglected condition.

In so far as they are centrally situated, near the markets, theatres, warehouses, railway-stations, etc., they tend to be overcrowded by persons irregularly employed.

In addition, there are a large number of insanitary dwellings in our large towns either gathered in small groups or standing isolated. Of these, in Manchester, over 5,000 have been condemned during the last sixteen years, and have either been closed or joined and altered to form houses with yards attached to them, and suitable sanitary conveniences.

The business part of the city is constantly encroaching on the inhabited part.

Houses are subdivided, and separate rooms let to families.

Overcrowding results, so that one evil is added to another.

Overcrowding is a condition very difficult to deal with. When times are prosperous all the houses available are filled and rents mount. Any movement by way of closing insanitary dwellings is at such a time acutely felt. It is true a wave of fresh building on the outskirts sets in, but this lags behind the increase of population, and overcrowding increases. When business declines, that part of the population which is not in regular employment migrates or crowds

up, and houses become empty. The overcrowding in individual dwellings is not thereby decreased. On the contrary, owing to lack of employment, it is apt to be increased.

In the aggregate, the effect of recent years of prosperity has been, however, to move the population outwards, under the conditions of transport now existing.

In dealing with these conditions it will be seen that much stress must necessarily be laid on administrative procedure. Overcrowding may be dealt with under the Public Health Act, 1875, and under by-laws relating to houses let in lodgings or occupied by members of more than one family. Practically, a considerable amount of discrimination must be exercised, especially where the overcrowding is due to occupation by members of one family. In any case, as overcrowding is an offence which has to be dealt with in a court of summary jurisdiction, it is necessary to convince the magistrates that it is one which can be avoided. On the other hand, if not dealt with as stringently as possible, it is a condition which is certain to increase, and to create difficulties for the future which may be practically insurmountable.

Similarly, the condition of the houses and of their surroundings as regards cleanliness is a matter for the sanitary authority to deal with under the Public Health Act, 1875.

Apart, however, from those conditions which are susceptible of treatment by the routine administration of the sanitary authority, there are others which require more radical treatment. How is the sanitary authority to proceed in the case of an area essentially insanitary by defective arrangement and structure?

The answer must differ with different conditions. Where there is much irregular employment of labour, so that the inhabitants of these areas require to be near their work, it may be impossible to remove them to a distance from the centre. Such, apparently, is the condition of affairs in London, Liverpool, and Glasgow, as in other seaports, and the Corporation of Liverpool have therefore adopted a large scheme for the demolition of houses on insanitary areas, and for the replacing of the inhabitants on the same areas. Including a number of areas within their scheme, they are reconstructing the houses on one area before closing those on the next,

so that the persons on the last area dealt with can be rehoused when their houses are closed. In this way a minimum of disturbance is effected. The utmost ingenuity has been shown by the city surveyor in providing cheap dwellings on the sites dealt with, in such a manner as to give abundance of light and atmospheric movement.

In Manchester there have been two movements, one a piecemeal closure of back-to-back dwellings, pursued steadily for a number of years, the dwellings being joined in a large proportion of instances to form through houses with yards, in others left closed. Out of 8,000 insanitary dwellings, mostly back-to-back, existing at the commencement of this movement in 1885, 5,000 have thus been dealt with. These lie in different parts of the city, and the operations of the Sanitary Committee have been conducted in such a manner as to cause as little overcrowding as possible. But, no doubt, a certain amount of overcrowding has resulted.

It has been held, however, by the chairman of the Sanitary Committee, Alderman Walton Smith, that these smaller alterations allow of a readjustment to take place, their aggregate effect being to aid in pushing the population outwards.

The large number of dwellings erected on the outer ring of the city in recent years would seem to favour this view.

But the Corporation have also cleared eight insanitary areas, and have provided houses on five of them, including tenements, cottages, and model lodging-houses. In this way provision has been made for 2,729 persons in lieu of 3,127 displaced. These have been costly operations, owing to the vested interests disturbed and to the high price of land in the centre of the city, and the Sanitary Committee have been drawn to the possibility of housing part, at all events, of the displaced population on the outskirts.

If it were possible, as a matter of general policy, to rehouse on the outskirts any considerable section of the working-class population living in the less sanitary parts of the city there is much to be said for doing so.

As Dr. Bailey and Professor Cohen have shown, the air of the suburbs is purer than that of the city; there is more light, less sulphurous acid, less carbonic acid, and less organic matter of a

putrescible character. Altogether the conditions are more favourable to a healthy existence.

There can be no doubt, apart from statistics, which in this matter are difficult properly to interpret, that a much more vigorous life is led by people living on the outer fringe of our large towns than is possible for those crowded together in the midst of smoke and organic impurities of various kinds.

Various projects have therefore been mooted or carried into effect.

One is to establish works in the country with colonies of working people around them, under healthy conditions of living. If this could be effected it would, doubtless, be an excellent thing for the health of the people, and the mere insistence upon its need may do something. But it may be regarded as certain that works will not be established unless special facilities as regards transport or otherwise, favouring the business, are in existence at any site for a works which may be selected.

Another plan is to house as many of the workpeople as possible in the neighbourhood of works which have been already planted, for reasons of convenience, on some particular site outside the town.

Of this character are the villages of Bournville and Port Sunlight. I have not seen the former, but I cannot too highly express my admiration of the energy and benevolence which have created the latter village.

Mr. Lever regards the provision of houses which he has made for his workpeople as a good business transaction. They are charged rents varying from 3s. 6d. to 5s., 5s. 6d., and 6s., according to the number of rooms. But to these rents must be added the rates, which the tenants pay in addition. Even so, there is no profit on the houses, which merely pay for cost of erection and repairs. They are part of Mr. Lever's scheme of prosperity sharing, which includes also a splendid dining-hall for the girls, a dining-room for the men, a summer theatre, an open-air swimming-bath, a museum, a billiard-room, a gymnasium, schools, and a church. Once established, these have to be maintained by the workpeople.

There is nothing wanting to separate vigorous existence of the community.

If this is business, it is a very noble and large-hearted business We must not forget to mention, in passing, the beauty of the houses and their variety of design, which give an idyllic character to the place.

But here, as at Bournville, the works come first, the site being one suitable to the business, and the houses follow.

However desirable it may be that such schemes should be more widely adopted, it is at once apparent that Sanitary Authorities must pause before attempting to proceed on similar lines, although they may reasonably derive encouragement from the history of the Artizans' Dwellings Company. It would seem, however, that the class of persons housed in their model industrial villages is not the very poorest.

It does not follow that Sanitary Authorities should not make some effort to improve the health of their population by the formation of colonies on the outer fringe. It is evident that land can be acquired much more cheaply on the outskirts than in the centre of the town, where, in Manchester, at all events, it is burdened with heavy chief rents. Is it possible in this way to reach the same stratum as the Liverpool Corporation are providing for? That could only be effected on these conditions: (1) That the transport to and from work should be convenient and at cheap rates; (2) that the houses erected are devised with the utmost regard to economy.

If these conditions were fulfilled, it would be possible to rehouse persons displaced in central parts of the city on the outskirts, and, if it were effected, there can be no doubt that the gain to the community would be considerable, in respect of the improved health and efficiency of the workers, and because of the increased vigour of the next generation. The pecuniary value of such gain would be very great, though it would not be possible to assign to it a definite figure.

The Manchester Corporation have been profoundly impressed with the necessity of getting the working-class population housed in the outer part of the city, as far as practicable, and on January 3, 1900, the Corporation sanctioned the purchase of the Blackley Estate, on the extreme northern boundary, at the price of £150 per acre, the total area being 237 acres. In proposing this purchase, Alderman

Walton Smith, the chairman of the Sanitary Committee, referred to the extensive closing of insanitary dwellings, which had extended over fourteen years, and stated that the need had been felt for provision of dwellings to balance the displacement of population caused by these and other operations.

He referred to the efforts which had been made by private enterprise, but did not consider that they were adequate to the requirements.

The estate was intended, however, to provide not only dwellings to relieve any pressure caused by the closing of insanitary dwellings and by public improvements, but to provide allotments under the Allotments Act.

On a careful survey, the area found suitable for dwellings amounted to 187 acres, 50 acres being left for allotments.

The City Council instructed the Sanitary Committee to provide on this estate 150 dwellings in lieu of others demolished under three improvement schemes, and fifty-three additional dwellings, as a commencement of their housing scheme.

On a consideration of the circumstances, it seemed advisable, as these dwellings would face or adjoin the principal road through the estate, not to provide the very poorest class of dwelling, and thus at the outset the Sanitary Committee found themselves under the necessity of erecting houses of a class beyond the means of the very poorest families. They considered, however, that advantage should be taken of the circumstances to vary the class of dwelling erected, and thus to discover what kind of dwelling was most likely to meet the requirements of artisans as well as to provide models which might usefully be followed by private builders. Much consideration was given to the type of dwellings to be erected, as a feeling exists that no adequate effort is made by private enterprise to provide dwellings either of sufficient variety of design or with sufficient conveniences.

The scheme proposed embraces dwellings of five different types, and has received the sanction of the Local Government Board. In the first instance eighty dwellings are to be erected, and are in course of construction.

The Blackley Estate is very well situated as regards facility of

transport, being served on two sides by electric trams, both coming from the centre, and also by a railway. It stands high, and the air is bracing and comparatively pure. There can be no doubt that the new houses will speedily be occupied, when it is proposed to complete the number of houses to be erected on these lines, and the new colony will be launched. In erecting these houses under Part III. of the Housing of the Working Classes Act, 1890, an important difficulty made itself felt.

The Housing of the Working Classes Act, 1890, makes no provision for the erection of shops, schools, churches, and other public institutions needed by a new colony, a need not felt in rehousing schemes in the centre of a town, but one which is imperative in an outlying district, and the Corporation have therefore found it necessary to apply to Parliament for powers enabling them to make provision of this character.

At this point, therefore, the development of the Blackley Estate stands at present.

In introducing the scheme, the chairman of the Sanitary Committee pointed out that it would necessarily develop slowly, the electric tramways coming up to the estate not being then constructed.

But there will be no unnecessary delay when the powers mentioned have been obtained.

It will be seen that two chief difficulties present themselves, the first being whether sufficiently cheap transport can be secured. It may be expected that this will be overcome.

The second is, how far workmen will be induced to live on the estate at a considerable distance from their work.

It is permissible to be sanguine on this score. Large numbers of workpeople are perfectly alive to the advantage of living under more healthy conditions, and the future of the project depends chiefly, if not entirely, on cheapness of transport.

It will be noted that the movement outwards has so far reached only families the income of which is above twenty-five shillings per week, and it is a very important question how far it will be possible to provide for poorer working-class families.

To answer this question we must postulate first that there is an

urgent need for dealing with insanitary houses and insanitary areas.

Now, the cost of the areas dealt with by the Manchester Corporation, including all arbitration charges, legal costs, trade compensations, and chief rents capitalized at thirty years' purchase, has varied from £5 6s. 9d. to £1 14s. 10½d. per square yard.

The Blackley Estate was purchased by the Corporation at £150 per acre, or 7s. 4d. per square yard.

Let us assume, for the sake of argument, that the whole estate is available for building purposes.

The smallest four-roomed houses at present erected have an area, including the yard, of 58·5 yards.

There is thus a difference in the value of the dearest land of the same extent in the centre already dealt with, and of a site of the same size at Blackley, of £310·05, which, at 3⅜ per cent., is equal to an annual charge of £10·46. The annual value of the difference on the least expensive site is £3·2,293.

These sums are equal to a weekly rent of 4s. and 1s. 2d. respectively.

Nor is this the whole difference. If the basis of the smaller area in the city be taken, there has to be added in the difference in price of the back passage.

It is true the large price paid for the clearance of the insanitary areas in the city is compensated for by enlarged streets and by other improvements.

If we assume that the working-class population displaced is housed on the Blackley Estate, it appears probable that it might pay the Corporation to provide for those displaced from an area equally expensive with the first-named on their Blackley Estate at comparatively low rentals, and that, at the price of a twopenny ticket for workmen to and from their work, it might still pay them to house, on their Blackley Estate, persons displaced from an area not more expensive than the least costly already cleared, selling the cleared areas for the erection of business premises.

It is assumed above that the land acquired could be sold at a cost approximating to the cost of clearance. This would not often be the case, even after it was held for some time. At the same time,

it might be good business in some instances to sell the central plot of land, and build dwellings, at a small rent, on the outskirts.

This is on the supposition that it is an imperative necessity to clear the insanitary houses away from considerable areas. But apart from insanitary areas, it may be next to impossible to find suitable sites for dwellings to house persons displaced by the condemnation of isolated houses, or blocks of houses, or by public improvements, and in that case there can be no doubt about the advisability of re-housing outside.

Further, it is not at all unlikely that works will be planted near the colony, when a sufficient number of inhabitants have been planted on the estate. In this way the cost of living would be reduced.

Apart altogether from the financial considerations of the kind touched upon above, as to which there may be some doubt, there is no doubt that it is good finance to remove as many as possible of the working-class families living in the centre of the city to a wholesome atmosphere, and with reasonable room to live in.

It is open to dispute how far Sanitary Authorities could be expected to engage in such a scheme for the housing of the working classes outside their own district.

The rates produced, then, go in aid, not of the Sanitary Authority, but of the district colonized, and it may be anticipated that such a proposal would be strenuously resisted. It is to be remembered, however, that the central Sanitary Authority would reap a harvest of increased vigour and efficiency on the part of the workers, and that, if it were possible to house suitably a considerable section of the working-class families now living in the centre in the outlying districts, an impulse would be given to the extension of large business premises over areas now occupied largely by insanitary dwellings.

Meantime, the scheme of the Manchester Corporation has not advanced so far as to show what can be effected in the direction of taking the labouring class to the outskirts, though we may hope that the experiment will prove successful in the only direction in which it could be supposed to fail—viz., in inducing a migration of persons of the labouring class outwards from the congested centre.

DISCUSSION

ON

A UNIFORM SCHEME OF EXAMINATION TO BE ADOPTED IN THE BACTERIOSCOPIC ANALYSIS OF WATER.*

I.

BY

WILLIAM G. SAVAGE, B.Sc. M.D. (Lond.), D.P.H.,
Medical Officer of Health for Colchester; late Lecturer on Bacteriology in University College, Cardiff; and Bacteriologist to the Cardiff and County Public Health Laboratory.

It will, I think, be admitted that at the present day there is but little uniformity in the processes adopted for the bacteriological examination of water by different experts and workers, both as regards the methods adopted, the way they are carried out, and the interpretation of the results so obtained.

To give but one illustration: I remember very well a water which I had been periodically examining for over two years, and which I had consistently condemned. The local authority in question were not satisfied, and sent fresh samples to two separate bacteriologists. The one obtained results quite different from mine, and said the water was perfectly satisfactory and free from contamination. The other obtained results very similar to those which I had been obtaining, but was satisfied that the water showed no evidence of contamination: the results were the same as mine, the interpretation was different.

The local authority, in perplexity, asked for and obtained a Local Government Board inquiry, which resulted in fresh samples being obtained and submitted to their own expert, who obtained precisely the same results and gave the same interpretation as I had given. This is perhaps an extreme instance, but it illustrates how widely divergent are methods and their interpretation among bacteriologists.

The other great analytical branch of examination for determining the purity of a water-supply—the chemical—being much

* Paper read at the Liverpool Congress of The Royal Institute of Public Health.

older, has gradually evolved for itself a fairly uniform scheme of examination, and text-book and laboratory practice both coincide in regarding the estimation of the total solids, the two ammonias, the chlorine, nitrates and nitrites, and certain other tests, as essential to determine the purity of a water-supply. Not only are these processes used universally, but the significance of the figures so obtained is fairly accurately apprised, and very considerable uniformity prevails.

As a consequence, the chemical method of examination, much less sensitive, in my opinion, than the bacteriological method, yet stands on a firmer footing, because of its uniformity. It is for us to ask ourselves whether the bacteriological examination cannot be put on an equal footing of uniformity, or at least on a better basis than it now occupies.

Everyone will agree as to the unsatisfactory nature of the present lack of uniformity, but probably we shall not so readily agree as to the possibility of its remedy. What are the difficulties which have to be overcome? Greater uniformity is required in reference to the following parts of the examination:

1. The methods of collection and transmission of the sample.
2. The data which it is desirable to ascertain.
3. The processes and procedures of the examination.
4. The significance to be attached to the results so obtained.

Is it possible to bring these things into uniformity? At any rate, it is obvious that much can be done, and I would suggest these points as worthy of discussion.

I. Collection and Transmission.

All who have had experience in the bacteriological examination of water will recognise the paramount importance of the *collection* of the sample.

A sample from a tap will not give, as we are all aware, the same results as a sample from the source, even with an unfiltered water. The influence of sedimentation on the number of bacteria is now universally recognised. A sample from the water flowing into a reservoir will not give the same results as one from the water just as it flows out.

I am personally of opinion that we require our samples to be collected much more frequently than they are from the source of the water—if, for example, it is an upland surface-water—for in such cases it is of less importance to determine the degree of purification which has taken place by sedimentation, etc., than it is to determine the possibility of pollution at the source. Samples must be taken from source and tap. The *depth* is also of importance for river and reservoir water, and here again uniformity is desirable.

In regard to the actual amount collected there seems to be a general consensus of method, small samples, 1 to 3 ounces, being used for routine examination, and a larger quantity—*e.g.*, in a Winchester quart bottle—for special organisms or processes.

In regard to transmission it is fairly well agreed that samples should be examined as soon as possible, and if not, that they should be ice-packed.

It is generally stated that ice-packing does not alter the bacterial content. Personally, I am by no means convinced of this, and although the number of organisms may remain practically undiminished, yet it may be that the relative abundance of different organisms is altered by the death of the less resistant at this temperature, and the survival and possible multiplication of the more resistant. At any rate, some uniformity of procedure might be arrived at.

II. Data to ascertain.

We have advanced beyond a mere enumeration of the total number of organisms, and some degree of qualitative examination has been reached. It is manifestly impossible, however, to isolate and identify every organism in a water-supply, and some uniformity of opinion might well be arrived at, as to what data it is most advantageous to determine. The following are perhaps the most in favour: (1) Number of aërobic organisms per c.c. developing at low temperature—*e.g.*, room temperature, to 22° C.; (2) Number of aërobic organisms per c.c. developing at 37° C.; (3) Investigation as to the presence of certain organisms especially liable to be associated with sewage or fæcal contamination,

such as *B. coli communis*, *B. enteritidis sporogenes*, streptococci, proteus organisms; (4) Examination for *B. typhosus* and *Sp. choleræ*.

III. Processes and Procedures of the Analysis.

It is in this part of the subject that I think uniformity is most required, while the difficulties are especially numerous. I will indicate the points which appear to me to be especially important, but doubtless many others will suggest themselves to you.

In the quantitative estimation it is obvious that to obtain comparable results many things are necessary. Uniformity of composition of media is a primary necessity. Not only must the media contain the same substances, and in the same form and proportions, they must also be made up by the same methods, while in particular the reaction must be a standard and uniform one. That alteration of these factors causes an alteration in the number of colonies which develop is a fact so well known that I need not dwell upon it.

The temperature of incubation and the date and method of counting might well be made uniform. At present some workers use gelatine plates of no definite reaction; others of standard but differing reactions. Some count daily until the plates are liquefied, others after a stated interval; some count only naked eye colonies, others count with a hand lens. Yet again, some incubate at room temperatures, others at 20° C., others at 22° C.

Turning to the qualitative examination, many differences prevail. As regards *B. coli* I do not know that a uniform *method* could be arrived at, and I am not certain that one is desirable; but uniformity is both possible and advisable as to, first, the amounts of water to examine, and, secondly, as to exactly what we mean by a *B. coli*.

Personally, I think it very necessary to realize that a numerical estimation is of vital import, and that to state that this organism is present or absent in one definite quantity of water does not take us far.

It seems very desirable that some limited and definite meaning be attached to the term *B. coli*, and a definite set of reactions

might be arrived at as essential before an organism can be called a true *B. coli*. Again, should the presence or absence of such characters be determined at once, or is rejuvenation by a preliminary incubation in broth desirable, as is claimed by Fuller and Johnson? Also, for organisms allied to *B. coli*, but outside the restricted group, should they be isolated and worked out, and is their detection of any practical utility?

For *B. enteritidis sporogenes* the procedure adopted is fairly uniform, but there are some unsettled matters. For instance, can the presence of this organism be affirmed without inoculation, and is it justifiable to call an organism *B. enteritidis sporogenes* if it produces the typical milk changes and microscopic appearance, but which on inoculation produces only a partial reaction—*i.e.*, local necrosis, but not death? I have met with several such organisms. Uniformity is desirable on these matters.

In regard to the methods for the examination for *B. typhosus* in water all methods are unsatisfactory, but a considerable degree of agreement exists as to the characters necessary to be worked out for an organism before it can be accepted as a true typhoid bacillus.

IV. Significance to be attached to the results obtained.

This, to me, is the most difficult part of the subject, and one on which uniformity in the present state of our knowledge is hardly possible. This, I believe, is to be very largely ascribed to the great want of uniformity in the methods of collection and transmission, to the want of uniform and standard media, and to the absence of definite lines of procedure, and if we put our house in order for these matters we shall subsequently be able to obtain clear ideas as to the significance of the results obtained.

I am strongly adverse to the setting up of arbitrary standards, to be widely applicable, at any rate with the present state of our knowledge. The kind of water under examination is of the utmost importance, just as it is for conclusions from chemical data.

With uniformity of method it is, I believe, possible to have

very satisfactory bacteriological standards for the different classes of waters. Thus, for the years 1901 and 1902 I find I examined bacteriologically 580 samples of water. They included all the public supplies of Glamorganshire examined quarterly, and a large number of isolated supplies, and were checked by chemical examination and by inspection of the source. The media used was of constant composition and reaction, and the methods of procedure were very similar. It was found that reliable working standards could be obtained and used, and ones which, in my opinion, gave results of higher value than the concurrent chemical examinations which were carried out side by side in the laboratory. Rigid arbitrary standards even then were found to be not possible.

Uniformity of method and procedure must, however, precede the formation of standards, while the latter can never be general, but must be applied separately to the different classes of water, and must be of some degree of elasticity.

In conclusion, I would say that I have touched upon what are, in my opinion, the difficulties and necessities of the subject. It is a subject which certainly can only benefit by discussion, and one upon which all those who have had experience in such work should state their views and experience, while I would go further and advocate the formation of a committee of English bacteriologists to take this and kindred matters in hand and to evolve some uniformity of procedure, leaving the significance of the results obtained to be subsequently determined.

II.

BY

G. LESLIE EASTES, M.B., B.Sc.

As this Congress includes amongst its numbers representatives of those authorities to whose care the public health of the kingdom is entrusted, all matters which concern the safeguarding of the health of the community lie properly within the scope of discussion—none more certainly fulfils this condition than the analysis of drinking-water. Hence, with regard to the standardization of bacteriological methods of water analysis, there is an obligation

on all who are called upon to address you to place fully before you the pros and cons of standardization, and your duty with respect thereto.

We are first confronted with the question whether there is any need for a uniform scheme of analysis. In my opinion there is an urgent need for such. This is evidenced by the fact that it has been thought necessary to introduce a discussion on the subject here. The necessity was voiced at a meeting of the Society of Chemical Industry at Burlington House last year, and in America it has passed out of the plane of discussion and attained actual fulfilment. The necessity for the standardization of methods is urgent, because of the prevailing confusion in bacterioscopic analysis. This is evidenced by the fact that hardly any two bacteriologists in the kingdom perform their analyses upon exactly the same lines, and is evidenced again by the text-books in general use, for no two of them recommend identical methods.

We therefore conclude that the subject of this discussion resolves itself into one question, to which it is the object of the meeting to find a definite answer. For all other questions depend for their solution upon the answer given to the important question, Are the times ripe for standardization of methods?—or, worded differently, Is the present knowledge of bacterioscopy of water sufficiently advanced to allow of the definition of the standard method?

Before answering this, let us consider for a moment the possible objections to a standard method. It may be objected that, by setting up a standard, it will be impossible to fix upon the ideal methods, as they are unattainable of accomplishment except in the hands of the few, whereas, to be of service, standards must be attainable by all qualified to practise them. This point may be conceded. It may then be objected that any standard short of the ideal cannot produce perfect results. But this objection is beside the point. The object of standardization of methods is not to produce perfect accuracy, but comparable results. The desire for comparable results, of which this debate is the expression, has, as I have previously remarked, become imperative. Again, it may be objected that, by crystallizing methods into a

standard it will follow that progress in bacterioscopy of water will be hindered. This is possible so far as the multitude of workers is concerned; but it is not with the multitude that progress lies, but with the few earnest seekers who never, in the course of the world's history, have allowed themselves to be trammelled by artificial limitations. The last and most serious objection is that the bacterial contents of natural waters are so complex, that they vary so enormously with the geological strata from which the waters are derived, and are so subject to profound alteration by the admixture of fluids or waters containing micro-organisms foreign to natural supplies, that it is impossible to define any one series of tests which shall serve universally as a means of ascertaining the bacterial content of that supply. But let us not deceive ourselves. To work out the flora of any one natural water from any given stratum may well be, with the exception of those that are sterile, a stupendous labour. The real object of this meeting is to discuss the possibility of attaining to a standard for the detection of bacterial impurity—in short, sewage contamination.

Such, then, being the real object of the discussion, we find that the original question which I laid before you is limited in an important degree, and may be more accurately re-stated as, "Is the present knowledge of bacterial methods of detecting sewage contamination sufficiently advanced to allow of the definition of the standard method?" This question can have but one of two answers—either yes or no. It is a case of excluded middle. This meeting is qualified in every respect—dignity, authority, and comprehensive representativeness—to answer this question, and its answer will carry such weight, if it be in the positive, that it will not be open to any other authority to oppose objections or deviate from its verdict.

I wish now to proceed to the consideration of the question which I have propounded, and such considerations as I lay before you will be largely my own personal opinions, based upon the results of my own experience and experiments, such being the result of a progressive series extending over a period of more than five years. I must state that much of my earlier work

was largely influenced by a close association with Pakes, a patient and accurate investigator into the bacterial flora of waters.

All bacteriologists are agreed that an investigation into the bacterial purity of waters must include a quantitative as well as one or more qualitative tests. Is our knowledge of methods of quantitative estimation sufficiently advanced to allow of the adoption of a standard? I think we may unhesitatingly answer Yes. It is known, from the work of Reinsch, Pohl, Sedgwick and Prescott, Pakes, Houston, and numerous other workers, that the constituents and reaction of the gelatin medium influence very largely the number of colonies which develop. The outcome of these experiments is that meat extract acts as a high deterrent towards the growth of natural water organisms, but not towards those which are facultative intestinal organisms. Hence Koch's standard gelatin yields results which do not approximate to the total in pure waters, but more nearly approximate to it in polluted waters. The most efficient medium for ascertaining the total bacterial content is jelly dissolved in the water under examination. This, however, can be but rarely obtainable. Most nearly approximating to this is jelly made with distilled water, and neutralized. Both these media are employed to ascertain the bacterial content at 20° C. In general, it may be stated that pure waters yield much higher figures on the distilled water jelly, and polluted waters higher totals on Koch's jelly. This alone is a valuable indication of the probable purity of a water. There is one other method that should be included, and that is agar-plates incubated at 39° C. The ratio of organisms capable of growth at body temperature to those which will only develop at room temperature being another valuable indication of purity or its reverse.

Here, then, we have three methods of estimating the total bacterial content, no one of which, taken alone, yields entirely reliable results, but which, worked in conjunction, yield results which give valuable information. All of these media have been in use for years. They are used in routine practice by several bacteriologists, and there appears not only to be no reason why they should not be universally employed, but every reason why

such should be the case, and I suggest that the standard method ought to include all three methods of quantitative analysis.

For the qualitative tests, however, we are faced by a more difficult problem. We find that various workers employ different methods; that few use two or more methods as a routine practice in the investigation of waters for "sewage organisms"; and that, therefore, the comparative values of each method are unattainable at present, or else based on insufficient evidence. Another difficulty is that bacteriologists are by no means unanimous in their opinions as to what are sewage organisms, or, if unanimous in that respect, are not so with regard to what should be sought in routine practice. All are agreed that there is at present no single known organism, the presence of which can be easily detected in water, and is absolute proof of contamination with fæcal material. All are agreed that the presence of the *B. coli communis* in small quantities is presumptive proof. But there is not even unanimity as to the highest dilution of the contamination which may pass as safe. Fortunately, however, we are not here to discuss what constitutes relative purity, but only the methods for ascertaining this. Now, these are restricted to four methods:

1. Parietti's method, and modifications thereof.
2. Pakes' method.
3. State Board of Health, Massachusetts, method.
4. MacConkey's bile-salt method.

There appears to be a growing conviction amongst bacteriologists that the theory of Parietti's method is fundamentally wrong, and I believe that its use has been generally discarded in America.

MacConkey's bile-salt method has not yet stood the test of experience in the hands of many workers.

Between the State Board method and that of Pakes there is little difference, except that an essential factor in the latter is anaerobiosis. The influence of this factor is of great importance, as many organisms will develop well aerobically in glucose-bouillon, the medium used by the Massachusetts State Board, which are not facultative anaerobes, and which therefore do not grow in

Pakes' method. On these grounds alone I advise the use of Pakes' method as a standard method to be adopted for the detection of the *B. coli communis.* Its delicacy is such as to render it from five to twenty times more accurate than Parietti's method—*i.e.*, by its use the *B. coli communis* may be found in 1 c.c. of water, in which that organism can only be found in from 5 c.c. to 20 c.c. by Parietti. But there is another cogent reason for using Pakes' method. It is by far the best means yet devised for the detection of streptococci in water. By its use their presence can be ascertained with the greatest ease. I have employed the method for this double purpose ever since the end of the year 1898, and regard it as far better than all other methods employed for that purpose. Other reasons can be adduced for the use of this method. One is that it entirely does away with the old plan, which was necessary in the days of the use of the less delicate tests, of filtering the water through a Berkefeld or other bacterial filter, a necessity which necessarily introduced a fallacy at the outset of the investigation. Finally, not the least of its advantages is its simplicity. The method is in use not only in different parts of this kingdom, but has been adopted as the official method in India, and is employed in other colonies. There is, gentlemen, a fascination in the conception of the adoption of a standard scheme for the entire Empire, whereby the whole of the English-speaking races shall be enabled to obtain comparable bacteriological analyses of water-supplies in all parts of the globe inhabited by them.

Having determined the standard method to be adopted for the preliminary stages in the isolation of coliform organisms, the methods of attaining proof should be easy of definition. I should recommend the use of lactose-litmus-agar for isolating, and the adoption of a series of tests, such as is used in America.

The methods which I have described are simple in application, require no exceptional bacteriological skill, are, moreover, in advance of, rather than behind, the requirements of the times, and, finally —and this is most important—yield accurate results, upon which alone it is possible to base an estimate of the purity of a water.

I have endeavoured to impress upon you that there is an

urgent need for the standardization of methods, that such is at the present moment attainable, and that it is therefore imperative that you should record your votes in favour of the adoption of standards whereby the confusion which at present exists, owing to the varying results of non-comparable methods, may be ended, before it results in the bacterioscopy of water falling into undeserved discredit.

If in your opinion, gentlemen, the times are ripe for the adoption of a universal scheme for the detection of bacterial impurity such as I have outlined, it becomes imperative that this meeting should forthwith determine, or delegate to a select committee of its own choice, the standard to be adopted throughout the kingdom by all who are qualified to practise the bacterioscopy of water.

Discussion.

F. J. Tanner, M.R.I.P.H., Bacteriologist to the Corporation of Bournemouth, said:

We are deeply indebted to Dr. Savage and Mr. Eastes for their valuable contributions upon the question of a uniform procedure in the bacteriological examination of water.

Personally, I feel the necessity for some definite agreement being come to, as on more than one occasion I have been asked to explain certain differences between the results of my examinations as compared with others. And it is not always easy to satisfy an unscientific corporation or sanitary committee that variations are liable to occur, even if a given water is sampled on two successive days, not to mention greater intervals.

I cordially agree with the importance of a standard routine being adopted, especially as regards reaction of media, and the various methods of qualitative and quantitative examination. If the outcome of this Conference leads to the realization of these proposals, it will be a matter for sincere congratulation.

I should also like to submit for your consideration the desirability of impressing upon those who require us to make bacteriological examinations the futility of *casual* examinations. You all know that many authoritative bodies responsible for public water-supplies think that they have done their duty if they have the

water submitted to bacteriological examination, say, four times a year. I maintain that a public supply should be examined bacteriologically at least once a month, and that records of the same should be preserved, so that results might be compared month by month and season by season.

Variations concerning bacteria are *bound* to occur. The effect of drought and flood should be watched for; filter-beds won't remain efficient for ever, and when changed need bacteriological supervision. And sundry unlooked-for causes of pollution occasionally make themselves manifest. Many of the forms of contamination are of an intermittent character, and it is obviously fallacious to imagine that because a water is declared to be free from suspicion once or twice a year that it is so between times.

Of course, the possible evils cannot be altogether obviated, however frequent the examination, but it will be generally admitted that the chance of contamination passing unnoticed would be materially diminished if more frequent examinations were systematically adopted. And I believe that much good would result if The Royal Institute of Public Health were to express itself upon the matter. Since the Journal of The Institute is taken in by various municipal and other bodies, the voice of the Journal in question is likely to have a far-reaching influence.

Professor R. T. HEWLETT, M.D., D.P.H., Professor of General Pathology and Bacteriology in King's College, London, alluded to the need for uniformity in the bacterioscopic examination of water. He said: If half a dozen chemists were to examine a sample of water, they would almost certainly examine for the same constituents in the same manner, and return the same figures for the analysis. In the bacteriological examination, on the other hand, there are a diversity of methods and of procedure. It would not be possible nor desirable at present to lay down a definite scheme of examination, but some sort of agreement might be come to as to quantities to be examined and data to be ascertained, with perhaps some suggestions as to methods. The bacteriological method is far more delicate than the chemical, if properly carried out, and it behoves all bacteriologists to conscientiously carry out the necessary procedures, lest discredit be

cast upon bacterioscopic analysis. Standard media are unquestionably needed. With regard to the *B. enteritidis sporogenes*, I do not consider that inoculation is necessary, as I believe that there are non-virulent varieties of this organism. Moreover, procedures involving the inoculation of animals should not be recommended if they can be done without, so that those who do not possess licenses may still be able to carry out the bacterioscopic analysis. Professor Hewlett concluded by advocating the formation of a committee to consider the question.

Dr. Glynn (Liverpool) eulogized the MacConkey bile-salt medium in the examination for the *B. coli*. He agreed with Professor Hewlett that there were non-virulent forms of the *B. enteritidis sporogenes*.

Dr. Buchanan (Glasgow) was doubtful as to the value of the search for the *B. enteritidis sporogenes* without the use of inoculation.

Professor Boyce, the President of the Section, said that he thought the chemists had lately been content with the methods they employed, and thus the chemical examination of water had to a large extent stood still. Unquestionably some amount of standardization in methods was most desirable. He was doubtful as to the value of the detection of the *B. enteritidis sporogenes* and other sporing forms.

Mr. Leslie Eastes then moved a resolution that the Council of The Royal Institute of Public Health should be recommended to appoint a committee to consider the question of the standardization of methods for the bacterioscopic examination of water, and to report to the next Congress.

The resolution was unanimously adopted.

The Council, in accordance with the above resolution, have appointed the following committee:

Professor Rubert Boyce, M.B., F.R.S., Chairman; Professor William R. Smith, M.D., D.Sc., F.R.S. Edin.; Professor R. T. Hewlett, M.D., M.R.C.P.; Professor G. Sims Woodhead, M.D., F.R.S. Edin.; G. Leslie Eastes, Esq., M.B., B.Sc.; William G. Savage, Esq , M.D., B.Sc.; Professor G. J. McWeeney, M.D.; John Eyre, Esq., M.D., F.R.S. Edin.; and Major W. H. Horrocks, R.A.M.C., M.B , B.Sc.

GERMICIDAL ACTION OF ALUM ON THE TYPHOID BACILLUS.*

BY

H. S. WILLSON, B.A., M.B. CANTAB., D.P.H.,
Demonstrator of Bacteriology in King's College, London.

IN the first instance, let me remind you of the chemical nature of alum. It is a double sulphate of Al and K (or Am), and it has a markedly acid reaction.

Its germicidal action, however, in drinking-water is practically never that of the double sulphate. The feeble alkalinity of the water causes a precipitation of the salt, the precipitate consisting mainly of the semi-gelatinous hydrate of aluminium.

To test the germicidal action, therefore, of alum as alum, distilled water must be used.

I made an emulsion of active typhoid bacilli in sterile distilled water, and added alum to the amount of 1 per cent. Subcultures were made from time to time, at first into broth, and afterwards on agar plates, so that larger amounts could be spread on the medium. In this way I found that the bacilli were not all destroyed until between four and five days. A second experiment gave a similar result.

Control emulsions in distilled water gave + results in broth at the end of five days.

Alum, then, as such, has a very feeble germicidal action on typhoid bacilli.

In ordinary drinking-water or river water the precipitated aluminium hydrate has remarkable purifying properties. Experiments carried out by Leeds, of Boston, in 1891, by A. and V. Babes and by Lankester in 1892, and by other workers, showed that the action of precipitate alum was not merely due to a mechanical entanglement of water organisms, but that the vast majority of these organisms were destroyed, even with such small amounts as 1 or 2 grains of alum per gallon of water. This has been confirmed many times. As a matter of curiosity I tried the effect of alum on some very muddy and foul Thames water. This water contained 3,000,000 organisms per c.c. I placed some of it in a tall glass cylinder. Its colour was dirty brown, and numerous animal organisms (Daphnia, Cyclops, etc.) could be seen swimming about. I then added alum in

* Read before the Liverpool Congress, 1903, of The Royal Institute of Public Health.

the proportion of 0·5 gramme to the litre (1 : 2,000, or 35 grains to the gallon), and allowed to stand for twenty-four hours. At the end of that time the water was perfectly clear to the eye, and at the bottom of the vessel was the usual flocculent precipitate. The bacteria had undergone enormous diminution. In the clear upper water there were 860 per c.c. ; in the sediment, after slight stirring, 20,000 per c.c. The animal organisms seemed unaffected, and were as lively as before.

I then made a few experiments to determine the action of alum on typhoid germs in drinking-water. The following is an example :

I took 100 c.c. of tap-water (from a cistern) in a graduated glass cylinder, and added first a few drops of a thick emulsion of typhoid bacilli, and then alum in the proportion of 10 grains to the gallon. This was allowed to stand for twenty-four hours, at the end of which time the semi-gelatinous hydrate had completely settled. Without disturbing the water, I withdrew 0·5 c.c. from near the surface and plated out.

Similarly, I took 0·1 c.c. from the sediment, and 0·2 c.c. after gently stirring the sediment, and plated out both of these quantities.

All the three plates showed typhoid colonies in great numbers, and almost in pure culture, very few colonies of other organisms being present.

I examined the water-tube again after six days had elapsed from the time of adding the alum. The tube was shaken up, to evenly distribute its contents, and 0·5 c.c. plated out in the same way as before. I obtained a pure culture of typhoid on the plates, and it was evident that the 0·5 c.c. still contained a large number of typhoid organisms.

The medium used for the plates was one devised by Horrocks, which I have frequently worked with. It consists of glucose-agar tinged blue with litmus, to which $\frac{N}{10}$ soda solution is added, 1·8 c.c. of $\frac{N}{10}$ soda to each 10 c.c. of the agar. On the surface of this medium solitary typhoid colonies look like drops of blue water after twenty-four hours' incubation at 37° C. If the colonies are crowded together, however, I have generally found that they produce sufficient acid to neutralize the alkalinity of the medium, and turn it faintly red.

The conclusion is, therefore, that although alum is a valuable agent for purifying water, and for getting rid of the ordinary water organisms, it is of no value as an agent for the destruction of typhoid germs.

BACTERIOLOGICAL NOTES.

ABSTRACTS FROM FOREIGN PUBLICATIONS.

THE NECESSITY AND THE PRACTICAL MEANS OF CONTROLLING PUBLIC DISINFECTIONS. M. A. CALMETTE, National Correspondent (*Bulletin of the Academy of Medicine*, May, 1903). —This communication refers to the necessity of the disinfection service in cities and villages, offering to the inhabitants all the necessary guarantees of efficiency required, and to the importance of verifying the competency of those who have charge of the processes and the apparatus for disinfection.

Dr. Calmette thinks this end may be reached by the aid of chemical and bacteriological tests, which can be easily prepared in the hygienic laboratories, varying according to the different processes employed and according to the nature of the contagious germs to be destroyed.

With the exception of steam disinfection, all the actual processes are based upon the employment of sulphurous acid or formaldehyde and its derivatives. For these agents, then, it is necessary to establish a means of control to determine if the penetration of the antiseptic has been sufficient to assure the destruction of the pathogenic germs, and if these in each particular case have been attacked.

The author gives an account of the results obtained according to experiments made by him at the Pasteur Institute of Lille as regards the processes based upon the employment of sulphurous acid.

The penetrative power of the antiseptic can be ascertained by the aid of a very simple chemical test. Glass tubes, 1 metre in length and graduated on the outside, are filled with fine sand coloured blue by means of litmus tincture. After the operation, the sand should be of a red colour to a depth of 25 centimetres, in order to destroy typhoid bacilli, and to a depth of 40 centimetres in order to destroy that of diphtheria.

The effects of the disinfection can also be ascertained with the aid of bacteriological tests by the use of small glass cylinders

sterilized, in which are afterwards placed strips of paper impregnated with pure cultures of the pathogenic microbes on which it is desired to experiment.

After the disinfection, these strips are immersed in tubes of bouillon, and forty-eight hours after the operation they are examined to see whether the cultures remain sterilized.

After numerous trials in verifying the processes of disinfection by formol, Dr. Calmette has adopted the following method: A certain quantity of hydro-alcoholic solution of fuchsine rubine is mixed with liquid horse serum, which is then dried in the drying-stove at 40°. Submitted to the formol vapours, these are immediately fixed, and the serum becomes insoluble in water, which is no longer stained by the colouring material.

The bacteriological disinfections with formol can also be controlled in the same manner as for sulphurous acid.

The result of the experiments made by Dr. Calmette at the Pasteur Institute of Lille will soon demonstrate with precision what quantities and what concentrations of sulphurous acid, of pure formol, or acetone formol must be employed in a room in order to effectually destroy each of the principal pathogenic germs.

The necessity of this control, adds the author in terminating, appears as indispensable to all hygienists, as is, for example, the inspection of pharmacies.

THE BACILLUS SUBTILIS AS CAUSE OF PANOPHTHALMIE IN MAN. DR. SILBERSCHMIDT, Privat Docent, Assistant at the Hygienic Institute of Zurich (*Annals of the Pasteur Institute*, April, 1903).—This work contains a description of panophthalmia in man, and relates the discovery, in the microscopic preparations, and in the cultures made with the *corps vitré* immediately after the extraction of the eye, of a great quantity of large bacilli apparently pertaining to the same species. The microbe does not present any spores; it is quite easily coloured with aniline, and does not become discoloured by the Gram method; it is rather aerobic.

From numerous experiments upon rabbits inoculated in the *corps vitré* with $\frac{1}{10}$ c.c. of emulsion of culture, it has been proved

that these animals were attacked by panophthalmia. This affection is more frequently caused in man by the introduction of a piece of iron in the cornea. Blacksmiths and other iron workers equally exposed to the lesions of iron, says the author, are rarely attacked with the acute form of the disease, while it is frequently found in agriculturists, who have received in the eye a morsel of iron proceeding from a pick-axe or an instrument employed in cultivating the soil, which renders possible the belief that panophthalmia can be reproduced with microbes of the soil.

It is possible to provoke this disease in a rabbit by inoculating an emulsion of earth in the *corps vitré* of the animal.

The *Bacillus subtilis*, when introduced into the *corps vitré*, remains localized in the eye, and does not spread itself into the blood nor into the organs of the rabbit inoculated in the eye.

On a New Streptothrix Polychromogene. H. Vallée of Alfort (*Annals of the Pasteur Institute*, April, 1903).—This article treats of a new chromogenious microbe, for which Mr. Vallée proposed the name of *Streptothrix polychromogene.* This microbe was isolated, in 1898, from the blood of a horse which had died from acute pasteurellose. It is aerobic, and may be cultivated in different media, always giving a characteristic culture. Its colouration is easily obtained by the Gram-Nicoll method. The cultures of *Streptothrix polychromogene* appear free from virulence, and their inoculation does not seem to provoke acute phenomena in large animals, even when young; but their poisonous action on the rabbit and the guinea-pig is evident, for these animals, inoculated with the cultures in peptone-bouillon, in about half the cases succumb at the end of three weeks, or the emaciation ceases, and they recover completely.

The particularities of the *Streptothrix polychromogene* are: a remarkable vegetability, the property of engendering colour pigments varying according to the place, interesting morphologic variations, and toxic properties more complete than those of other non-pathogenic oospora.

CHEMICAL NOTES.

Action of the Septic Tank on Acid Iron Sewage. L. P. Kinnicutt and H. P. Eddy. (From the Fourth Annual Report of the Connecticut Sewerage Commission.)—The results of another year's work confirm the authors' preliminary conclusions (*Journ. Soc. Chem. Ind.*, 1902, 1092), and show that by the slow passage through a closed septic tank of an acid iron sewage containing, in 100,000 parts, 5 to 8 parts of dissolved iron, about 10 parts of free (sulphuric) acid, and about 1 part of albuminoid ammonia—

1. About 25 per cent. of the total solid matter, including about 20 per cent. of the total soluble matter, is removed.

2. The amount of suspended matter removed will not greatly exceed 30 per cent., unless special means are taken to retain in the tank the finely divided iron sulphide. Of this suspended matter, 60 to 70 per cent. will remain in the tank, and will have to be removed as sludge, only 40 to 30 per cent. being rendered soluble or gaseous by bacterial action. The actual weight of sludge, however, will only be half as great as it would be if formed in a precipitation tank, owing to the smaller proportion of water in the sludge formed in a septic tank. If the sewage contain street washings, about half the total solid matter will be mineral, and more than one-third of this will be iron sulphide.

3. The amount of organic matter removed will average 20 to 25 per cent., including nearly 50 per cent. of the suspended organic matter, and not much more than 10 per cent. of the dissolved organic matter.

4. The gases given off contain methane (about 75 per cent.), carbon dioxide (about 6 per cent.), and nitrogen (about 19 per cent.). Hydrogen and hydrogen sulphide are absent. Gas is always evolved at temperatures above 45° C., averaging, with Worcester (Connecticut, U.S.A.) sewage, about 0·25 cubic feet in the coldest months, and about 1 cubic foot in the warmest months, per 100 gallons of sewage.

Recent Advances in the Bacterial Examination of Water. W. H. Jollyman. (*Analyst*, 1903, 28 [327], 169-183).—In the author's opinion, a pure water generally develops a larger number

of bacteria on a neutral 10 per cent. solution of gelatin in pure water than on Koch's meat-extract gelatin medium, but a polluted water usually gives the reverse result. The methods of isolating *B. coli communis* are discussed, anaerobic cultivation at 37° C. in broth containing 2 per cent. of glucose and 0·4 per cent. of sodium formate being preferred. Pakes' method was found to be well adapted for proving the presence of streptococci, although the occurrence of the latter being due to pollution is considered questionable. As regards the separation of *B. typhosus*, the isolation of this organism is deemed to be a matter of chance. The author, in conclusion, is of opinion that a bacteriological examination of a sample of water affords a more delicate and definite means of detecting pollution than a chemical analysis.

USE OF FORMALDEHYDE IN PREPARATION OF NUTRITIVE SUBSTANCES. C. GOLDSCHMIDT. (*Chem. Zeit.*, 1903, xxvii. [40], 484.)—If equal parts of milk and a 40 per cent. solution of formaldehyde are mixed, a precipitate is immediately formed, which, after filtering and drying, forms a white powder, containing only traces of formaldehyde. It contains the nutritive constituents of milk, and may be used as a food.

Animal blood and formaldehyde form a jelly, which dries to a brown powder. This might also serve as a nutrient. Both compounds resemble Blum's preparation from albumin and formaldehyde.

MATERIALS AND APPARATUS FOR SOFTENING WATER. C. E. CHALLIS, London.—(*Eng. Pat.*, 7,436, March 27, 1902.)—The materials claimed are the oxalates or binoxalates of soda, potash, or ammonia, with or without the addition of ammonium chloride. Soap powder may also be added, and the mixture put up in packets containing suitable quantities for softening definite volumes of hard water. To facilitate the treatment of large volumes of water, apparatus is described for automatically measuring or weighing definite proportions of water and of the mixture for softening it.

HEALTH LECTURES.

The following lecturers have been appointed in connection with the Health Lectures to be given during the months of October, November, and December, 1903, by The Royal Institute of Public Health:

Barrow-in-Furness.

Tuesday,	*October*	6.	Professor William R. Smith, M.D., D.Sc., F.R.S.Edin.
,,	,,	13.	J. B. Cohen, Esq., Ph.D., Lecturer on Chemistry in the Yorkshire College, Leeds.
,,	,,	20.	Professor C. S. Sherrington M.D., F.R.S., Professor of Physiology in the University of Liverpool.

Oldham.

Saturday,	*November*	7.	Professor William R. Smith, M.D., D.Sc., F.R.S.Edin.
,,	,,	14.	C. H. Tattersall, Esq., M.R.C.S., L.S.Sc. Durh., Medical Officer of Health for Salford.
,,	,,	21.	Andrew Wilson, Esq., Ph.D., F.R.S.Edin.

Reading.

Thursday,	*November*	12.	Professor William R. Smith, M.D., D.Sc., F.R.S.Edin.
,,	,,	19.	James Cantlie, Esq., M.A., M.B.
,,	,,	26.	Professor Sir William Ramsay, K.C.B., Ph.D., LL.D., F.R.S.

Chester.

Tuesday,	*November*	17.	Professor William R. Smith, M.D., D.Sc., F.R.S.Edin.
,,	,,	24.	Professor Rubert Boyce, M.D., F.R.S., Professor of Pathology in the University of Liverpool.
,,	*December*	1.	Surgeon-General G. J. H. Evatt, C.B., M.D., Principal Medical Officer of the Second Army Corps.

Stockport.

Friday,	*November*	20.	Professor William R. Smith, M.D., D.Sc., F.R.S.Edin.
,,	,,	27.	J. S. Cameron, Esq., M.D., B.Sc., Medical Officer of Health for Leeds.
,,	*December*	4.	Professor G. Sims Woodhead, M.D., F.R.S.Edin., Professor of Pathology in the University of Cambridge.

COPY OF CORRESPONDENCE WITH THE EDUCATION DEPARTMENT RELATIVE TO THE APPOINTMENT OF A MEDICAL ADVISER TO THE BOARD.

"THE ROYAL INSTITUTE OF PUBLIC HEALTH,
"19, BLOOMSBURY SQUARE,
"*February* 3, 1903.

"MY LORD MARQUIS,

"I have the honour, by direction of the Council of the above Royal Institute, to inform your Lordship that they have had under consideration the many important health questions connected with the working of the Education Act, 1902, and other allied statutes, and they venture very respectfully to urge upon your Lordship's notice the great necessity which, in their opinion, exists for the Board of Education having at its disposal the services of a skilled and experienced medical officer as one of its permanent staff.

"The various Education Acts provide that all children have to be educated, such education entailing the aggregation in various centres of that portion of the community which is most susceptible to infectious disease, and from this point of view alone the Council are of opinion that the Board of Education require the services of a medical officer: for not only should the educational machinery of the country be in complete and sympathetic relationship with that of the many Sanitary Authorities and their medical officers, but various problems relative to the alleged spread of infectious disease in schools require elucidation, and such administrative steps insisted upon as will reduce any such risks to a minimum; and they feel it is impossible for a proper solution of these questions to be obtained unless the work is permanently carried out under the advice of such an official.

"I am further directed to remind you that under Section 88 of the Education Code an appeal lies to the Education Department relative to the closing of a school because of the prevalence of infectious disease, and they feel it is impossible for the Education Board to exercise a right judgment in the matter unless they have proper medical advice. The Council are informed that the Department has been in the habit in the past of seeking this advice from the medical officer of the Local Government Board, but they venture to point out that such a procedure cannot be regarded as satisfactory. The question further has received additional importance consequent upon the alteration of the Code, which enables grants of money to be made for absences occasioned by infectious diseases in the homes of scholars, for this alteration involves the expenditure of large sums of public money.

"The Council are informed that for London alone the School Board obtained from the Government, in little more than eighteen months, no less a sum than £12,000. The total amount thus given for the whole country must be very large.

"They find also, on reference to the Report of the Departmental Committee on defective and epileptic children appointed by the Education Department, that the appointment of a medical officer to the Board is strongly urged (Clause 195), so that the Department may be advised on all matters arising out of the education of defective and epileptic children, and that the homes and classes for such children should be subject to his inspection, and by the Elementary Education (Defective and Epileptic Children) Act of 1899, Section 1 (3), medical advice has now to be sought by all education authorities, which should be subjected to central supervision.

"Further, there are numerous questions affecting the health of all classes of

teachers, their superannuation, the proper interpretation of medical certificates, etc., which cannot be dealt with without medical aid.

"The Council likewise feel that the many important questions involved in the proper construction, from a public health point of view, of school buildings, such as the ventilation, lighting, kinds of desks, etc., should be subject to the advice of an experienced medical officer.

"Indeed, the Council are at a loss to understand how it is possible for such an important Government department as that dealing with the education of the children of the country, to be properly administered without the services of such an official.

"They are aware that not only has the School Board for London for some years had the services of a medical officer, but that educational authorities generally throughout the country are making such appointments; and if the necessity exists for a school authority to have such services at its disposal, the Council are convinced that the Government department which co-ordinates the educational work of the country should be likewise so provided.

"The Council feel very strongly, in the public health interests of the community, the urgent necessity for such an appointment, by which means a skilled and experienced direction could be exercised and maintained over the many public health questions affecting the welfare of the children, and through them that of the adult portion of the community; and they venture to express the strong hope that, from a consideration of the above points, your Lordship will be able to give them the assurance that the Board of Education will have a medical officer as one of its permanent officials.

"I am,
"My Lord Marquis,
"Your obedient servant.
"JAMES CANTLIE,
"*Honorary Secretary.*"

"BOARD OF EDUCATION,
"WHITEHALL, S.W.,
"*July* 3, 1903.

"SIR,

"Your letter of June 22 to Sir William Anson has been handed to me, and in reply I have to state, for the information of the Council of The Royal Institute of Public Health, that the Board of Education, as at present advised, do not regard the appointment of a special medical officer, or the creation of a special department under the Board of Education corresponding to the Medical Department of the Local Government Board, as necessary, or even as expedient.

"The Board are fully alive to the necessity for sanitary inspection of school premises, and they do not dispute that the position of schools in regard to the dissemination of epidemic diseases calls for close examination. But they would direct attention to the fact that such work in the area of each Local Authority can be carried out as part of the general duties of the medical officers of the Sanitary Authorities, whose work is administratively supervised by the Local Government Board, advised by their medical officer and by the medical inspectors. The Board of Education cannot but feel that the administrative supervision of the work of local medical officers by one department in regard to some duties, and by another department in regard to other duties of a cognate kind, would be an arrangement not free from the possibilities of friction, and certainly open to objection as a duplication of official machinery.

"The reference in your letter to the closing of a school in compliance with an Order of the Sanitary Authority, presents a case in which the Board venture to think that the practice hitherto followed ought not to be lightly departed from. The closing of a school is a step which has to be taken by the Sanitary Authority after consideration, not only of its efficacy as a means of safe-guarding the health of the children, but also of its possible effect on the health of the rest of the community. In considering an appeal from the action of a Local Sanitary Authority, a medical officer of the Board of Education would either have to take into account the same circumstances as those which would determine the view of the corresponding officer at the Local Government Board, in which case his office would appear to be one that ought to be dispensed with, or else he would judge the action of the Sanitary Authority from a narrower point of view than that of his colleague, who has to consider the general hygienic interest of the community. Your Council will understand how extremely unfortunate a position would present itself if this department reversed the action of a Sanitary Authority in a case where the Local Government Board, with more complete information to guide them and with fuller powers, decided to support the Authority.

"Your Council probably know that since the writing of your letter Article 101* of the Code has been revised, and that no grants are claimable for absence owing to sickness after March 31 last.

"The Board admit that their duties in the administration of the Defective and Epileptic Children Act, 1899, are such as to make it necessary that they should have expert advice, but they would venture to point out that there is little connection between this part of their work and the general work, for which your Council urge the selection of a permanent, special medical officer. This general work certainly resembles very closely, if it is not, as the Board think, properly part of, that of the medical officers of the Local Government Board, and an officer appointed to perform it would not necessarily be qualified to discharge the duties in regard to defective and epileptic children, now performed by one of His Majesty's Inspectors who holds the Degree of M.D., and has given special attention to the problems involved in the education of this unfortunate class of children.

"The Board are not prepared to admit that questions arising in connection with the ventilation and lighting of school buildings cannot be adequately dealt with by an architect. They do not think the necessity for taking a medical opinion in these matters would be a matter for anything but a general reference, and they have no doubt that if such reference were found necessary, competent advice would be forthcoming from the members of their present staff who have medical qualifications.

"In conclusion, I have to say that it is certainly convenient, and perhaps necessary, for the Board to have on their staff a gentleman who can afford them for their guidance a competent medical opinion, but they do not consider that at present there is any reason for arming the Board of Education with executive powers corresponding to those exercised by the Local Government Board over Local Sanitary Authorities.

"Yours faithfully,

"LONDONDERRY.

WILLIAM R. SMITH, Esq., M.D.,
"President,
"The Royal Institute of Public Health."

"THE ROYAL INSTITUTE OF PUBLIC HEALTH,
"19, BLOOMSBURY SQUARE,
"*July* 16, 1903.

"MY LORD MARQUIS,

"I have the honour to acknowledge the receipt of your Lordship's letter of the 3rd instant, and to express the Council's indebtedness to your Lordship for so fully dealing with the subject.

"The Council recognise, and are in entire sympathy with, the tendency of recent and proposed legislation to entrust the administration of the Education Acts to the local Municipal Authorities, for they feel that necessarily the Medical Officers of Health of the country will be able to exercise a much greater voice in matters of school hygiene than has been possible for them in the past. And they feel assured that in all matters particularly concerning the spread and prevention of infectious disease these officers are most capable, and may be trusted to render effective service; and as regards the subject of the closure of schools, they feel that the provision for an appeal to the Education Department is perhaps unnecessary, and may in the future be found to be best vested in the Local Government Board, although it is possible that, consequent upon the Education Authority being also practically the Public Health Authority, this appeal will be but rarely, if at all, resorted to. The Council are aware that Article 101 of the Code has been revised, and they are disposed to view the withholding of this part with less concern than they would have otherwise done, because of the abolition of School Boards, as they feel sure the proper exclusion of children from school will be insisted upon by the Local Authorities, and that no other considerations than those of health will, under these circumstances, operate with the new Educational Authorities.

"Whilst, however, admitting fully that, in all matters affecting infectious diseases, and possibly in some questions of construction of schools, the services of local medical health officers will be fully available, the Council are, nevertheless, convinced that a department of State dealing wholly with the young should have at its disposal the services of a skilled medical consultant, for there are many questions affecting the health of the children which would not naturally come under the notice of a Medical Officer of Health, and which are vital to the well-being of the community, and upon which the Board of Education should be able, under the advice of such an officer, to render real national service. To mention but one of these, the poor physical condition of the children—a subject of far-reaching importance, and one in which this Council takes a deep interest—it cannot, the Council think, be denied that the unique experience of the Education Department, if properly organized, would be of the greatest value, not only in determining the causes, but in suggesting the remedies for this national evil.

Your Lordship has specially alluded to the duties of the Education Board under the Defective and Epileptic Children Act of 1899, which was the outcome of the report of a Departmental Committee on the subject; and your Lordship will, I think, find that one of the recommendations of that Report was that the Board should have a medical adviser. The Council are much interested in this special work, and have watched with care its development in the country. They are also conversant with the value of the work of the Inspector to whom your Lordship alludes, but they feel that the possibilities of such a work, which naturally commends itself to the philanthropic, are likely to be greatly overestimated, and, not only that much unnecessary expense may be incurred, but positive injury done, unless the work is systematically controlled.

"The Council, with all respect, venture to disagree with your Lordship's suggestion as to the specialization of a medical man for this work, nor do they suggest that it is desirable for the Education Department to have a medical department in any sense comparable to that of the Local Government Board; but they would again venture to urge that it is desirable and necessary that the Education Department should have on its staff a medical adviser of wide experience, without private work as a physician, who not only is fully conversant with health problems and questions of school hygiene, but who is fully acquainted with the selection of proper children for defective and epileptic centres, and who should also be in entire sympathy with the right education of such.

"With apologies to your Lordship for the length of this communication,

"I have the honour to be,

"My Lord Marquis,

"Your obedient servant,

"WILLIAM R. SMITH, M.D.,

"*President.*"

"WHITEHALL,

"LONDON, S.W.,

"*July* 22, 1903.

"DEAR SIR,

"Lord Londonderry desires me to say, in reply to your letter of the 16th instant, that he has noted the opinion of your Council as to the desirability and necessity of the attachment of a special medical adviser to the staff of the Board of Education. He does not think that he can usefully add anything to his letter of July 3.

"I am,

"Yours faithfully,

"W. R. DAVIES.

"WILLIAM R. SMITH, ESQ., M.D.,

"The Royal Institute of Public Health,

19, Bloomsbury Square, W.C."

LEGAL NOTES.

THE Vice-Chancellor of the High Court of Ireland has, at the instance of the Attorney-General, on behalf of certain inhabitants of Clonskeagh, a suburb of Dublin, issued an injunction restraining the Urban District Councils of Rathmines and Pembroke from maintaining an isolation hospital at Vergemont, near Clonskeagh, for the reception of small-pox cases. It was shown in evidence that 750 persons resided within a quarter of a mile of the site, and 2,682 within half a mile. The Irish Local Government Board, which does not insist on the conditions laid down by the English Board in cases of small-pox hospitals, had approved the site without restriction. The Vice-Chancellor, in granting the injunction so far as small-pox was concerned, stated that whether the infection of small-pox was spread by aerial convection or not, he was of opinion that there was danger to the inhabitants of this populous neighbourhood from the use of this hospital as a small-pox hospital.

HILLS *v.* DAVIES.

In this case the respondent, the advertising manager of the Royal Duchess Theatre, Balham, was charged with an offence under Section 60 (3) of the Metropolitan Police Act, 1839 (2 and 3 Vict., c. 47), in that he had scattered and thrown out over the roadway printed bills of a play to be performed at the theatre.

The magistrate dismissed the information on the ground that paper thrown on the road was not litter.

LORD ALVERSTONE, L.C.J., said the case must go back to the magistrate, as the real question for his consideration is one of fact—viz., whether these printed advertisements were thrown in such quantities as to cause litter in the ordinary and popular sense, and whether, under the circumstances, the litter was so thrown as to be an offence.

WINSBARROW *v.* LONDON JOINT STOCK BANK.

The respondents had caused to be hung out from the front of their premises, No. 22, Victoria Street, three reflector lights made of glass, which hung over the pavement to the extent of 4 feet, at a height of 15 feet above the pavement, and were fixed into the brickwork of the building by pegs or staples, and were summoned by the appellant, an Assistant Engineer and Surveyor to the City of Westminster, for an offence alleged to have been committed under Section 65 of the Metropolitan Paving Act, 1817.

The magistrate dismissed the summons.

LORD ALVERSTONE, L.C.J.: The section applies to temporary matters. These reflectors were not movable, and were safely fixed to the walls. Section 65 is clearly inapplicable.

LAWFORD *v.* BILLERICAY RURAL DISTRICT COUNCIL.

The appellant was an engineer engaged by an agreement under seal to carry out certain works within the district of the respondent Council. After the completion of his work it was discovered that the drainage of an area not included in the original scheme required attention, and the appellant, at the request of a committee to whom the matter had been referred by a resolution of the Council, visited the area and did work in connection with the new scheme. The appellant agreed with the Clerk of the respondent Council that the agreement of the previous engagement should be held to apply to the new work on certain terms, and he duly did all that he was instructed to do by the committee, whose acts were all confirmed by the respondent Council. When the appellant claimed his remuneration a dispute arose as to the amount to which he was entitled, and when he declined to accept the amount which the respondent Council offered him, the respondent Council took up the position that, there being no agreement under seal, the plaintiff could not compel them to pay anything.

The appellant then brought an action to recover, which was tried by DARLING, J., who held that, in the absence of an agreement under seal, the appellant could not recover.

VAUGHAN WILLIAMS, L.J., with STIRLING, L.J., and MATHEW, L.J., held that, in the absence of statutory provisions to the contrary, a corporate local authority is liable on an implied contract to pay for goods supplied or work done at the request of, and accepted by, the Authority, where the goods supplied or the work done are necessitated by the purposes for which the Authority is created.

The want of an express contract under seal is no defence to an action brought against the Authority to recover payment for the work done or the goods supplied. (*Clarke* v. *Cuckfield Union*, 1852, and *Nicholson* v. *Bradfield Union*, 1866, approved.)

The case gives leading authority for a very important exception to the general rule that the contracts of a corporate body must be under seal. There are two already well-recognised exceptions to this general rule: firstly, the case of matters for the performance of which the statutory body was created, and which could not be performed in time unless the necessity of a seal were not dispensed with; and, secondly, the case of trivial matters or matters of frequent occurrence. The principle upon which the appellant successfully relied in this case was indicated in the judgment of *Hall* v. *Swansea Corporation*, 1844, where it was decided that an action for money had and received lies against a Corporation. The statutory provision in the case of Urban Authorities contained in Section 174 (1) of the Public Health Act, 1875, requires that the contract of an Urban Authority under that Act must be under seal if the value or amount of the contract exceeds £50.

CONSETT URBAN DISTRICT COUNCIL *v.* CRAWFORD.

This was a case stated by the Justices for the County of Durham, who had dismissed an information brought by the appellant Council under Section 306 of the Public Health Act, 1875, in the following circumstances:

The Council resolved on July 2, 1902, that the whole district be inspected by the full Council, and on July 16 a notice was served on the respondent requiring him to abate a nuisance within two months.

On July 24, 1902, seven members of the Council, with certain officers of the Council and the County Medical Officer of Health, went into the yard of the premises belonging to the respondent. Two of the councillors were talking outside, and the others were inside, when the respondent and his son came up and asked if an inspection was being made. He was informed that it was so, and that the councillors, doctors, and inspectors were inside. He then pulled the door to, put a padlock on, and locked them in, thereby preventing the two councillors who were outside from going in, and those who were inside from coming out.

The Justices held that the councillors and officers were not admitted to the premises within the meaning of the Public Health Act, 1875, Section 102, and that the respondent had not wilfully obstructed them in the execution of the Public Health Act.

The Council appealed against this decision. The Court, LORD ALVERSTONE, L.C.J., WILLS, J., and CHANNELL, J., held that the appeal should be dismissed, because the appellants entered of their own motion, a course which is not justified by Section 102 of the Public Health Act. The section provides for the case where admission is not refused and for the case where admission is refused. Here there had been no opportunity of refusal, and as there is provision for the case where there is no one on the premises, or where the person having the custody of the premises cannot be found, there must in this case be an opportunity of refusal. The appellants went in of their own motion, and consequently cannot be said to have been acting in the execution of their duty.

PUBLIC HEALTH MEDICAL APPOINTMENTS.

DAWES, R. S. M., L.R.C.P. Lond., Health Officer for Gawler South, South Australia.

ELLIOTT, Charles Bolton, L.R.C.P. Lond., Medical Officer of Health for Geraldton, West Australia.

FOWLER, C. E. P., Captain R.A.M.C., Assistant Professor of Military Hygiene, Royal Army Medical College.

BOOKS, PAPERS, ETC., RECEIVED.

The following books, papers, etc., have been received:

The Lancet; The British Medical Journal; The Sanitary Record; The Surveyor; The Medical Times and Hospital Gazette; The Medical Review; The Pharmaceutical Journal; The Councillor and Guardian; Albany Medical Annals; The Glasgow Medical Journal; Public Health; The Journal of the Society of Chemical Industry; Egésyég; La Presse Médicale; La Salute Pubblica; The Journal of Tropical Medicine; The Caledonian Medical Journal; The Public Health Engineer; The Journal of the United Service Institution; The Journal of the Association of Military Surgeons of the United States.

Annual Reports: Government of Assam; Bombay; Punjab; Local Government Board, Lurgan; Merionethshire.

Letters, Notes, Queries, etc.

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Communications which have been sent to other journals cannot be received.

Correspondents who wish notice to be taken of their communications should authenticate them with their names—of course not necessarily for publication.

Telephone number of The Royal Institute of Public Health, No. 1614 Central.

The Journal of State Medicine.

THE OFFICIAL ORGAN OF
THE ROYAL INSTITUTE OF PUBLIC HEALTH.

VOL. XI.] OCTOBER, 1903. [No. 10.

PREVENTIVE MEASURES AGAINST TUBERCULOSIS IN LARGE TOWNS.

BY

NATHAN RAW, M.D., M.R.C.P.LOND., F.R.S.EDIN.,
Physician to Mill Road Infirmary and Sanatorium for Consumption, Liverpool.

I APPRECIATE very highly the privilege of being allowed to introduce this important subject before this great Congress, and I sincerely hope that the distinguished speakers who will take part in the discussion will be able to support and corroborate the views which I think ought to be placed before you.

We all know now that consumption is a preventable and curable disease, but few of us thoroughly appreciate the amount of mental and physical suffering which is caused by its ravages, especially amongst the poorer classes of a great community like Liverpool.

The greater part of my daily professional work is amongst the very poor of this city, and when I tell you that during the last six years I have had under my observation over 2,000 people suffering from consumption of the lungs, you will more readily realize the gravity and importance of doing something to check the progress of the disease.

I will not attempt, in this paper, to say anything with regard to the scientific side of this difficult problem, but prefer to-day to deal with the social and more practical side of the question.

How can this great waste of human life be prevented? and what means are we as a city to adopt in treating the disease of these unfortunate sufferers?

I am glad to say that the onward march of sanitation and hygiene, with which you are all familiar, has to an extraordinary extent

diminished tuberculosis by providing proper and decent accommodation for the working classes instead of damp, dark cellar dwellings, with no fresh air or sunlight, and no attempt at ventilation.

Liverpool is in the van of progress in the demolition of insanitary property, and the proper housing of the working classes, but this, in itself, is a difficult social problem, as the mere provision of sanitary houses will not be any guarantee that they will long remain so, owing to the ignorance and depravity of a certain section of the community in a large city like ours. The only possible way to reach these people is to educate them by their fellow-workers, and there can be no doubt that this is being done rapidly throughout the country.

It is sad to think that in Liverpool alone over 2,000 persons die every year from consumption. And I have estimated that there are at present between 5,000 and 6,000 people suffering from the disease in its various stages in Liverpool.

The average duration of the disease is three years, and this to the working man or woman means three years of misery and suffering, not only to himself, but to his wife and family; and what is even more important, he is for three years a source of danger to those with whom he is brought in contact.

I have often asked myself the question, "What is a respectable working man to do when he is attacked by phthisis?" His money is exhausted by seeking advice, medicine, and other necessaries, then where is he to go? The general hospitals will not admit him, and he is compelled by dire necessity to unwillingly enter the workhouse, or the workhouse infirmary, and so become chargeable to the rates of the city. By this time it is in many cases too late to cure him, and he is simply left to die, as I have seen hundreds die in Liverpool, without being able to render any more assistance than to make them comfortable to the last.

If these men could have been received into an institution when the disease was in its early stages, they would most probably have been cured and spared for further earning power, and the cost would have been no more to the city than chargeability to the poor rate.

With all respect, I maintain that a citizen of any city is entitled to be maintained by the community when afflicted with sickness, as he is an integral part of that community. The wealth of the

State depended on the individuals who composed the State, and if the individuals were poor, the State was poor.

I have made a calculation, and find that in Liverpool alone the working classes lose about £300,000 a year in wages when suffering from consumption.

Adequate provision is made for every disease excepting the one which kills most people, and if taken in time is more easily cured than most other diseases.

The Poor Law Guardians of this city have done a noble and splendid work by combining together to tackle this problem.

They have erected a splendid sanatorium for the treatment and cure of this disease in its early stages at Heswall entirely and solely for the poor of this city, and I am glad to say that the results up to the present have been most encouraging.

At the present time there are between 500 and 600 consumptives in the workhouses and other Poor Law institutions in this city. The point I wish to make is that it is the duty of the municipality, through its Corporation, and not the Poor Law authorities, to make provision for this disease, and the people ought not to be allowed to drift into the workhouses as they do at present, and so incur the stigma attached thereto.

One-seventh of the total pauperism of this country results from phthisis, and if the municipality were to seriously undertake its prevention and cure, it would simply mean that the cost would be transferred from the poor rate to the municipal rate.

Statistics show that consumption is rapidly diminishing in every country where any serious effort has been made to check its ravages. In the year 1839 in England the death-rate from consumption was 38 per 10,000. At the present time it has decreased to 13 per 10,000, and I quite hope to live long enough to see tuberculosis entirely stamped out of this country. In my opinion this diminution has been brought about chiefly by the improved social and sanitary condition of the people, but also to a great extent by the increased knowledge of the profession and the people themselves regarding the infectious nature of consumption. This education of the people has to a great extent been provided by the National Association for the Prevention of Consumption, and I am proud to

say that our worthy President to-day (Lord Derby) is also President of the council of that association. Lord Derby has this subject thoroughly at heart, and has done an immense service to the country in this crusade.

The chairman of that council is a distinguished member of our profession—Sir William Broadbent, who has devoted an immense amount of time and energy in this good cause.

One result of this education is, that the people recognise the danger of promiscuous spitting, and Liverpool may be congratulated on being one of the first cities in the country to enforce bye-laws to prevent spitting on tramcars.

This has since been followed by the London County Council, and when this disgusting habit is prevented by law throughout the country, there will be removed one great cause of the spread of consumption.

I have said before that the disease is infectious, but I want it to be clearly understood that this is only the case when ordinary precautions are not observed, and that there is no danger whatever from the association of a consumptive with other members of the family, provided he takes care not to cough or be in close contact with a healthy person, and also that he carefully destroys all his expectoration. For this reason it would be absurd and unwise to classify tuberculosis amongst the scheduled infectious diseases, such as scarlet fever or small-pox, but it *is* necessary to draw up special regulations, and to place it in a separate and special category by itself.

This brings us to the question of notification of the disease to the health authorities. At the present time I am personally strongly opposed to making it a compulsory notifiable disease, but the present system of voluntary notification in Liverpool should be developed. At the present time the Liverpool health authorities carefully disinfect any house in which a consumptive has lived or died if no objection is made, and I know of several lodging-house keepers in Liverpool who will not take in a person with a cough on account of this disinfection.

It is an ascertained fact that the wellbeing of young children depends largely upon the purity of milk. It is sad to think that

200 out of every 1,000 children born in Liverpool die before they reach the age of one year.

What a sacrifice of infant life! In my opinion, after a most careful consideration and examination of the question, I am persuaded that the great scientist, Professor Koch, has led us into error by stating publicly that tuberculosis could not be conveyed to children by milk. I am convinced that it is so conveyed, and that it is accountable for a great loss of infant life.

It is an undisputed fact that 20 per cent. of all dairy cattle in this country are suffering from tuberculosis, and until this state of affairs is rectified we must expect a great mortality from feeding children on uncooked cow's milk.

The Health Committee of this city has recognised this danger long ago, and is at present providing the public with sterilized milk at a small cost per week, and I am informed by Councillor Shelmerdine, who has worked so hard at this question, that over 60,000 bottles of milk are so supplied weekly.

The result of supplying this sterilized milk in Battersea has been to reduce the deaths of infants from 140 to 64 per 1,000 births, a most humane and gratifying result. May Liverpool continue in this good work.

The milk supply of Liverpool should be most jealously guarded by the health authorities, and tuberculous cows removed from all dairy herds, especially those cows suffering from tuberculosis of the udder.

The public should take care that all milk should be sterilized or boiled before use by children; it is not so important in the case of adults.

Persons suffering from consumption in an advanced stage are a great danger, and perhaps these cases are the *greatest* factor in the spread of the disease. Experiments have shown that in the act of coughing and sneezing these people are able to infect other persons for a distance of one yard.

Hence it is of the greatest importance that these cases should be removed if possible from their small dwellings and single rooms into some hospital, and made comfortable to the end.

For the early or curable cases occurring amongst the citizens of

this city, I would strongly advocate a municipal sanatorium, where each person would pay according to his means, and have the right of admission.

At the present time the man employed in an office or other occupation when attacked by consumption has no place to go to and no means of cure. The generosity of Lady Willox and Mr. Hartley has provided a splendid sanatorium at Delamere, and it is doing a grand work, but it is too small and too expensive.

If Liverpool could procure an estate in some healthy locality and establish a consumptive colony, where all afflicted with this disease could be congregated, on the same lines as an epileptic colony, it would do more to solve the problem than anything else. I hope this suggestion may be considered by the health authorities of this city, so ably advised by Dr. Hope, its esteemed Medical Officer of Health.

And now, with these general remarks I beg to submit to the Congress a scheme for the prevention and treatment of consumption in Liverpool, and I have the greatest pleasure in stating that it is the joint production of one of Liverpool's greatest philanthropists, the late Mr. William Rathbone, and myself. I submitted the draft scheme, and Mr. Rathbone corrected every word of it, and added many useful and practical suggestions. I should say this was the last public work that noble-minded man did and it was his hope and desire that Liverpool would adopt it.

The scheme was also most carefully considered by our President, Lord Derby, who personally examined it most carefully, and I have his authority for stating that he thoroughly approves of it. Under these circumstances, although it was drawn up two years ago, I submit it to you without alteration, and can only sincerely hope it will receive that consideration from the health authorities of this city which the importance of the subject demands.

Scheme for the Prevention and Treatment of Consumption in Liverpool.

Introduction.—Tuberculosis, or consumption, is a preventable and curable disease, and is solely caused by the entrance into the system—generally by inhalation—of germs named tubercle bacilli.

The disease is infectious, and may, if proper precautions are not adopted, be conveyed from one person to another by contact, or, as in the large majority of cases, by the inhalation of the dried expectoration of the consumptive, which contains millions of bacilli. It is proper, however, to point out that, with ordinary care in the treatment of a person suffering from consumption, there is no danger whatever of infection to a healthy person.

The mortality from tuberculosis is alarming. It is estimated that over 500,000 persons die every year in Europe alone from this disease, and of that number 60,000 persons die annually in Great Britain. Such a loss of human life makes it compulsory that all Governments should strictly inquire into and adopt measures to arrest the propagation of a disease which, in these days, is the greatest enemy of the human race.

It was generally believed until quite recently that the disease was hereditary and incurable, but we now know that this is not so; and, though the children of consumptive parents may occasionally exhibit a predisposition to the disease, yet, with care, there is no reason why they should develop consumption.

The remedy for such a widespread disease as tuberculosis is, however, difficult to apply, and can only be done effectively by organized effort on the part of the health authorities, the medical profession, and the public at large. Any individual efforts, so far as the general eradication of the disease is concerned, must be futile.

NUMBER OF CASES IN LIVERPOOL.—It is estimated that about 2,000 persons die every year in Liverpool from this disease, and, calculating this illness to have an average duration of three years, we may conclude that the number of consumptive persons in Liverpool is 6,000. Now, we know that consumption is, generally speaking, a disease of the poor; consequently, we may assume that over 4,000 of these cases, at least, exist at present among the working classes.

It is for this class that some special legislation is required—this vast population of persons who earn their living by labour. In the words of Sir John Burdon Sanderson, "They may not be destitute, and are not objects of charity, but the conditions under which they live are so unfavourable as to render them more liable than the well-

to-do classes to the invasion of the tuberculous infection. When such a person becomes consumptive, he loses the one possession which constitutes his working capital: he loses his earning power. As the disease progresses the burden of poverty becomes harder and harder to bear. He suffers himself, and those who are dependent on him for their subsistence suffer with him. Their condition is helpless, and, unless there are some more effectual means of aiding them than are at present available, hopeless." It is sad indeed to see in our workhouses in Liverpool men who have been in respectable positions in life dragged down to destitution, through no fault of their own, by this disease.

The earning power of the workman is a commodity far too valuable to be wasted, and the duty of preserving it is no less incumbent on us as citizens than as Christians. The duty of the municipality is already, by law, to provide this, and it is in the interests of the ratepayers for them to do so. It is our custom in Liverpool to be in the front rank in fulfilling such duties of citizenship, and all we entreat is that this duty shall be performed without delay.

COMPARISON OF MORTALITY IN LAST THREE DECADES.—It is gratifying to see from the report of the Medical Officer that the mortality from tuberculosis in this city has been reduced from 430 per 100,000 of the population in 1866 to 1875, to 253 in 1896 to 1900—a reduction in the deaths from consumption of nearly 50 per cent. This has been accomplished by improved sanitation and education, and experience shows that, in the light of our present knowledge as to the cause of the disease, it will in time be no longer a public danger.

MORTALITY AS COMPARED WITH OTHER INFECTIOUS DISEASES IN LIVERPOOL.—The deaths from tuberculosis in Liverpool are about the same as the deaths from all other infectious diseases put together, and when we observe the extraordinary improvement which has taken place in the mortality from infectious diseases since their treatment was undertaken by the municipality, it is evident that the same improvement would follow if tuberculosis were in this list of diseases, and treated as we propose. As examples, typhus fever and eprosy have been almost stamped out altogether.

THE PROPER AUTHORITIES TO UNDERTAKE THE PROBLEM.—The two authorities capable of undertaking this necessary work are the County Council and municipalities.

In a large and populous city like Liverpool the municipality is the only authority which could possibly undertake this duty. It has control of all the factors necessary for success, such as the abolition of insanitary dwellings, proper hygienic surroundings, sanitary appliances, and all the machinery of an important health department, besides having the penal powers necessary to enforce them.

It is not suggested, however, that consumption should be classified amongst the dangerous infectious diseases with compulsory notification and isolation. Voluntary notification is now happily in force, and beyond that it would not—at present, at least—be desirable to go until public opinion is more fully enlightened.

The Poor Law Authorities in Liverpool will always continue to have a large number of pauper consumptives, and, as at present, will give them the best possible treatment, but the prevention of the disease is no part of their duty; hence, this most important division of the work would have to be undertaken by the municipality.

NECESSARY LEGAL POWERS.—The health authority of Liverpool has full power under the Public Health Acts to deal with consumption in all its phases, and no further powers are required.

FINANCE.—This is the most important factor in the scheme. It would be necessary first of all for the municipality to organize some central department in the city at which all consumptives could apply for advice, and possibly treatment; then to provide one or more municipal sanatoria for the treatment of the early or curable cases, and also to provide accommodation for the hopeless or advanced cases, who are at present lying in their own homes, and acting as centres of infection and distributors of the disease to other occupants of the house. The estimated cost to the municipality would be an initial capital expenditure of £25,000 for the purchase of an estate and erection of a municipal sanatorium. This would be borrowed at a low rate of interest spread over many years.

The annual expenditure would probably amount to not more in

the present circumstances than £7,000 a year, this to include the provision of a central municipal dispensary, a sanatorium for early cases, and hospital accommodation for 100 incurable and hopeless cases.

The total expenditure would be equivalent to a rate of ½d. in the pound, as a 1d. rate in Liverpool will produce about £15,000.

Of course, it is essential that every person who used the municipal sanatoria would be required to pay according to his means, and cases received from the Poor Law Unions would be charged the current rate of cost in exactly the same way as lunatics in the county asylums. The cost to the city would be speedily balanced to a great extent by the relief of the poor rate owing to the breadwinner being cured or relieved, instead of being allowed to become a burden on the rates.

Methods to be Adopted.—It would be necessary to appoint a Tuberculosis Committee under the control of the Health Department, working in conjunction with the general practitioners and charity organizations of the city. This committee to decide all details as to treatment in a sanatorium, the financial position of the patient, disinfection, and isolation if requested.

The institutions necessary to carry out this plan would be:

1. A centrally located tuberculosis office, at which all consumptives might come to seek advice and counsel, and where strict inquiries might be made by the committee.

2. A municipal sanatorium in some healthy district near to Liverpool where the early cases might be treated and cured, the patient in all cases to pay according to his means.

This sanatorium should contain at least 100 beds, and be within the reach of any needy citizen.

3. A reception hospital for at least 100 incurable cases, who could, if they desired, be removed from their poor surroundings, and not only be made comfortable during their short lives, but no longer be allowed to live in the densely populated parts of our city as the most potent agents in distributing the disease.

Suggestion.—I would suggest in the first place that a conference should be convened by the Lord Mayor of the city, consisting of

representatives of the Corporation, of the medical profession and the lay public, to consider and express an opinion on this most important matter.

CONCLUSION.—Public opinion has been so roused within the last few years with regard to the prevention and curability of tuberculosis, that the time is now ripe for the subject to be undertaken by the municipal authority of the city. It is for the great working class of the city that this appeal is made, those who would gladly accept relief if it could be given, but who would decline to ask relief from the unions until they were compelled. In a few years it may be a matter of extreme difficulty, if not an impossibility, for a consumptive to find ordinary means of employment, as, unless these precautions are taken, public opinion may become so alarmed by the possibilities of danger from infection that ordinary workers in factories, workshops, and offices will object to their presence in the same rooms.

The municipality can, by offering to cure these early cases, prevent them otherwise drifting into poverty and chargeability to the rates, and, by isolating the incurable cases, largely prevent the disease from being spread to healthy members of the community.

Liverpool has, so far, been the pioneer in the provinces in the matter of tuberculosis and sanitary matters generally. Only last year the first sanatorium of its kind was opened at Delamere Forest, and the president of the Local Government Board has recently laid the foundation-stone of a sanatorium for consumptive paupers. These are both pioneer movements, but they only deal with a limited number of cases, and Parliament has placed in the hands of corporations and County Councils the duties and necessary powers to deal with this and other important diseases as affecting the great majority of the community. I sincerely hope that Liverpool will set an example to the country in being the first to undertake the municipal control of the cruellest scourge that has ever fallen on us, our children, and our fellow-countrymen.

N.B.—Since writing this scheme, I may say that Heswall Sanatorium is now open and doing excellent work.

BOVINE TUBERCULOSIS AND PUBLIC HEALTH.

BY

J. McLAUCHLAN YOUNG, F.R.C.V.S., F.R.S. EDIN.,

Lecturer on Veterinary Hygiene in the University of Aberdeen.

THE pronouncement of Dr. Koch before the British Congress on tuberculosis in 1901, although somewhat startling, has indeed served a useful purpose; for not only has it been productive of a Royal Commission and a vast amount of public and private investigation, but I venture to think it has been the means of attracting greater attention on the part of the public to the subject of tuberculosis in man and the lower animals.

The statement, doubtless familiar to all, came as a disappointment to the scientist and the worker in public health, as it meant their energies had been misdirected, and in many cases public moneys uselessly expended. To the members of the meat and milk trades, it was a pleasant surprise to be told their wares played a most insignificant part in the dissemination of the disease. I purposely say surprise, as I cannot but think the vast majority of those engaged in these trades believed flesh or milk of a manifestly diseased animal to be a distinct menace to public health. A few, as we have learned from several speeches at the Congress, accepted without further consideration the dictum as an established fact, and as but corroborating the opinions long held by themselves. In concluding that part of his address referring especially to the possibility of bovine tuberculosis being transmitted to man, Dr. Koch said: "I should estimate the extent of infection by milk and flesh of tubercular cattle and the butter made of their milk as hardly greater than that of hereditary transmission, and I therefore do not deem it advisable to take any measures against it."

With the weight of such an authority behind it, it was impossible to overrate the effect such a statement would have on authorities disbursing, in a conscientious endeavour to safeguard the public, large sums of money on meat inspection and the inspection of dairies and cows.

Fortunately, however, we have in this country eminent men

whose work has been so valuable, so trustworthy, as to inspire the public with confidence in their advice, and to them is due the honour that no relaxation was made of the precautionary and preventive measures, and no retrograde step taken by our public authorities These men did not accept nor did they deny Koch's conclusions, but unanimously declared further proof was necessary, and until that was forthcoming no remission should be made in our laws and by-laws for public health. It would appear, as time goes on, that the chance of any remission becomes more remote; for, as Koch himself desired, his experiments have been repeated in this and other countries, and the results have been directly contradictory to those obtained by him and his colleague, Schütz. The fact that he was unable to produce lesions in cattle by inoculating them with tubercle bacilli from man he made the basis of his argument that human tuberculosis differs from bovine, and it is important to note how far his contention can be supported.

I believe the first contradictory note was sounded by a member of the veterinary profession—Sir G. Brown—who, on taking the chair the following day at the meeting of the Veterinary Section, said during the work of the first Royal Commission, which went on from 1890 to 1895, he had inoculated cattle with human sputum, and they had taken tuberculosis. He also remembered injecting some human sputum from Brompton Hospital into the peritoneal cavity of a calf, and the animal became tuberculous. Crookshank at that time also injected tubercular material from a human source into the peritoneal cavity of a calf, and although the calf died from septicæmia, he records there was sufficient evidence to prove that the bacilli had produced a tuberculous focus. Investigation in this direction, however, was not then extensively pursued, as, on the authority of Koch himself, it was believed by pathologists that human and bovine tuberculosis were similar, varying but slightly because of environment. Thus it was not until he had made his surprising statement that deliberate and adequate investigation was undertaken to show the relation of human to bovine tuberculosis.

A considerable time must elapse ere the reports of all such experiments are published, as, with few exceptions, tubercle develops slowly, necessitating the keeping of the inoculated animals for a

lengthened period. The question is so important professionally and commercially that it would be well to have it finally settled, and although the results already published seem quite conclusive, until the volume of evidence which is now accumulating has been collated and analyzed, the final verdict should not be pronounced.

I have the honour to be associated with Professor Hamilton, under the auspices of the Aberdeen University and the Highland and Agricultural Society of Scotland, in an investigation the report of which has just been published, and the results obtained were such as to leave no doubt in our minds that human tubercle can be readily inoculated upon bovines. In undertaking the investigation, our object was to ascertain if the bacillus taken from its natural habitat in man, without being subjected to any influence which might modify its process of reproduction, is capable of transmitting the disease to the bovine host, and in order to do so twenty calves were experimented upon. This number is said to be too small to afford conclusive deductions, but it must be remembered that Koch made his pronouncement on what he termed "absolutely conclusive results" from inoculations upon nineteen young cattle. He used a larger number of cattle, and also swine, asses, sheep, and goats, but only nineteen cattle had tubercular material from a human source introduced into their bodies by one method or another. The experiments where cattle were inoculated with tuberculosis of bovine origin had no bearing whatever on the point in question, and beyond again demonstrating that the disease is capable of transmission from one animal to another of the same species, they afforded no evidence of the relationship of human and bovine tuberculosis. The inoculation of human and bovine bacilli upon swine, asses, sheep, and goats proved the bovine bacillus to be more virulent for these animals than that of man, but in so proving it is at once suggested that the bovine bacillus might be also more virulent for man.

Except when guinea-pigs were used for confirmation purposes, all our experiments were made on young cattle, as we had but one object in view—viz., to determine whether human tuberculosis can be conferred upon bovines or not. In selecting the experimental animals several important details had to be considered. They must

be absolutely free from tuberculosis, and as hereditary tuberculosis is a pathological variety, it follows that the younger the animal the more likely it is to be free from the disease. Sound animals one or two years of age might be obtained by using the tuberculin test and the process of rejection, but it had to be proved that the injection of tuberculin did not interfere with the susceptibility or the immunity of the animal to the bacilli about to be introduced. It is well known a tuberculous animal is immune to a second testing with tuberculin until a sufficient interval has elapsed between the testings, and it is quite possible the immunity thus produced might render valueless the subsequent inoculation with human tuberculosis. To keep the animal sufficiently long after the testing before introducing the tubercular material would not be satisfactory, as there would always remain the possibility of contracting the disease during the interval. This explains why one lot of calves in our experiments were not tested. In the subsequent experiments, however, it was proved that tuberculin affords no such immunity. This was especially well seen in three cases where the animals were twice tested during the first two months of their existence, and on post-mortem examination these animals were extensively diseased. The calves were all obtained from the same source, and their youth, when recorded with the negative results given to the tuberculin test by the others, makes it highly improbable that these purposely untested animals were, to begin with, tuberculous.

They proved, however, that the injection of tuberculin, although it may for a time render a tuberculous animal immune to a second testing, it had no such effect against bacilli when introduced into the body by any of the various methods. This part of the investigation was necessary, since Koch tested all his animals before subjecting them to the human bacilli; and if the test had any power to confer immunity, even for a brief period, that fact might have explained his failure to reproduce the disease.

In a large majority of the twenty calves conclusive tubercular lesions were produced, and in the cases open to doubt there is little question, had the animals been kept longer before slaughter, the lesions would have become so apparent as to satisfy the most exacting critic. As it was, the enlargement of the glands attracted atten-

tion, and on examination they proved to be more than suspicious of tuberculosis.

The appearance of the glands was not simply that of the ordinary somewhat enlarged glands of the young animal, whose diet consists chiefly of milk, but the histological structure was interfered with; and this alteration of structure, especially when confined to the glands of the gastro-intestinal tract in those cases where the tubercular material was introduced along with the food, was, to say the least, gravely suggestive of tubercular origin.

But to the main point. Is human tuberculosis transmissible to cattle? On the principle that seeing is believing, I have no hesitation in answering in the affirmative. The more crucial question, Is bovine tuberculosis communicable to man? can never be proved experimentally; but many cases of accidental inoculation have been recorded, and if analogical deductions are of any value, public authorities and private individuals must use every endeavour to minimize the opportunities whereby the disease might be transmitted. As will be generally agreed, there are but two ways by which the disease is likely to be transmitted from the bovine to the human race—viz., aerial and alimentary.

The first can quickly be dismissed, because the requirements of most authorities as to the cubic capacity and ventilation of byres make the chance of the attendants contracting the disease in this manner extremely remote. An individual in such an indifferent state of health as to offer exceptionally favourable conditions for the development of tuberculosis contracted in this way would not be physically able to attend to cattle, so that time need not be taken to discuss this possible but improbable source of infection. By the food-supply the disease is more likely to be transmitted; but this danger must not be exaggerated. That the flesh of tuberculous animals is capable of conveying the disease there is little doubt; but when we consider that the lesions are mostly found in those parts not used for food, or, at least, in parts easily removed, and that the flesh is cooked before being ingested, it becomes apparent that the danger has been overrated. All meat inspectors' reports show that tubercular lesions are found most frequently in parts not used for food, or in parts which could be easily removed without damage to the carcass;

and records of 300 post-mortem examinations I made while carrying out certain investigations show that lesions were present to the following extent: Lungs, 75; bronchial glands, 75; mediastinal glands, 39; mesenteric glands, 32; pleura, 32; liver, 26; pharyngeal glands, 15; mammary glands, 15; peritoneum, 8.

By the removal of the diseased organs or parts the carcass might be rendered fit for food, and it certainly would be safe if the Freibank system of Germany was introduced into this country. There they recognise certain carcasses to be unwholesome only when uncooked, and the meat, after being cut up into pieces of about 4 pounds, is cooked under the supervision of the officials, and sold to the poorer classes at a reduced rate. Assuredly we have in this country a poor but deserving class to whom such meat, at reduced prices, would be an incalculable benefit.

Lastly, there is the milk as a possible source of infection, and I believe this to be the most potent factor in the transmission of tuberculosis from cattle to man. Milk constitutes the major portion of the child's diet; but in the infant body there is not that antagonistic resistance to disease found in the healthy, vigorous adult, and the scarcely more than viable child is given milk which may have been drawn from a tubercular udder, and which contains the bacilli only too easily absorbed by the lymphatics. The result is a tubercular focus, which may at once become sufficiently destructive as to cause the death of the child, and increase the already high infantile mortality. On the other hand, this focus may remain in abeyance until some future period in the host's life, when, because of some systemic disturbance, most favourable opportunities are offered for its development. This development and extension may not take place until adult life, but the infection took place during infancy, when on the diet of milk. All milk, however, is not to be looked upon as dangerous, or even treated with suspicion, as only when the cow is suffering from tubercular mammitis does the milk possess a virulency capable of inducing tuberculosis in the consumer. The results* of eighty-three inoculations made with milk in the usual way show this in a striking manner, as not a single animal

* Stenström Olof, *Zeitschr. f. Tiermed*, Bd. vi., 1902, p. 241.

used for inoculation contracted tuberculosis, although the cows in many instances had been in the highest degree tuberculous. These results coincide with those obtained in an investigation* into the milk of cows which had reacted to the tuberculin test, where it was found, after most careful examination, that the milk drawn from tuberculous udders was alone capable of producing tuberculosis in guinea-pigs.

Although the danger is limited to milk from tuberculous udders, and the percentage of such cases is not high—say, 5 per cent.—we have no security against mixed milk, as it is the custom to mix together the milk of many cows. This, of course, dilutes the bacilli-ladened milk of the one cow; but the organism is more widely distributed, and thereby a larger number of children are exposed to a possible source of infection.

In conclusion, I think it has been abundantly proved that human tuberculosis is capable of transmission to bovines, and, although it may never be conclusively decided, I venture the opinion that the converse is equally true, viz., that bovine tuberculosis is transmissible to man. If we, then, are of that opinion, it is clearly our duty, on such occasions as has been the means of bringing us together to-day, to advise authorities and individuals to make use of all scientific endeavours to remove the opportunities by which such transmission may take place, and, concurrently, to be untiring in their efforts to reduce the prevalence of tuberculosis in the bovine race.

* *Highland and Agricultural Society's Transactions*, 1903.

THE HARBEN LECTURES, 1903.

The Harben Lectures for 1903 will be given by Professor Ferdinand Hueppe, M.D., of the University of Prague, by the kind permission of the Principal of King's College, in the Lecture Theatre of King's College, at 5 p.m., on the following dates:

Thursday, October 8. Subject: The Etiology of Infectious Diseases from the Standpoint of Natural Science.
Monday, October 12. Subject: Hygienic Lessons to be derived from the Serum Treatment.
Thursday, October 15. Subject: Tuberculosis.

These lectures are free, and the attendance of Fellows and Members of The Royal Institute is requested.

THE SUSCEPTIBILITY OF THE PIG TO HUMAN TUBERCULOSIS.*

BY

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AND

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THE frequency with which tuberculosis occurs in the pig varies greatly in different countries. Nocard points out that it is particularly frequent where there is a large milk industry, and where the animals are fed on skimmed milk and the refuse from centrifugalized milk. In Denmark, for example, 14 per cent. of the pigs slaughtered are found to be infected, whereas in the United States the disease is extremely rare, the ratio being only 1 in 10,000.

It is generally agreed that the bovine species is the common source of this infection in the pig, and the lesions in such cases point to ingestion as the primary means of infection. The tonsillar and intestinal lymphatic glands are first attacked, often without visible lesion of the mucous membrane.

A marked feature of natural tuberculosis in the pig is the common occurrence in the viscera of large encapsulated tubercles, which can be readily shelled out from the organs. These have a marked resemblance to the solitary tubercles which are sometimes found in the human subject, especially in the central nervous system.

The close association of man and the pig, particularly in certain countries, makes the question whether tuberculosis of human origin is capable of giving rise to infection in this animal especially interesting, and this might form a suitable inquiry from the statistical side.

In the course of a series of experiments carried out by us at the suggestion of Lord Lister, we obtained certain results bearing on this point.

The first series of experiments consisted in inoculating pigs

* A paper read at the Liverpool Congress of The Royal Institute of Public Health, 1903.

subcutaneously with sputum from patients suffering from advanced pulmonary tuberculosis. Six pigs were so inoculated, and five of these succumbed as the result of the tuberculous infection. The sixth pig, when killed 227 days after inoculation, presented well-marked tuberculous lesions. In some of the animals the course run by the disease was extremely acute; thus, one of the animals died in thirty-one days, and another in forty-seven days, after the infection. In all these animals there was a local tuberculous focus; the glands and the lungs were infected in every case, and in some the liver, kidneys, and spleen were also affected. In certain of the animals where the infective process was prolonged the tuberculous nodules showed the same encapsulated, sharply circumscribed character which is met with in the natural infection. From a number of the lesions pure cultivations of the tubercle bacillus were successfully obtained, and in all the animals the bacillus was demonstrated histologically and by animal experiments.

The second series consisted of three pigs which were fed with human tuberculous sputum. In all of these a local tuberculosis of the lymphatic glands was demonstrated.

The three animals used for these experiments were from a litter of seven, bred from a healthy sow. Three were kept as controls, and one was used for another experiment (subcutaneous injection).

When the animals were two months old they were removed from the sow, and were fed on coarse wheat meal ("middlings"), mixed with water to which tuberculous sputum was added.

The animals received, as a rule, each about 15 c.c. at one feeding, but on two occasions very much larger quantities were given—about 100 c.c.* to each animal.

Nearly two months after the beginning of the experiments the average weight of the three controls was 53 pounds, whereas the average weight of the three experimental animals was 27 pounds.

These three animals all died after a period of about eighty days with severe emaciation, and showed a tuberculous infection of the tonsillar and cervical glands.

Professor Koch, in the paper in which he formulated his recently

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* Full details of these experiments will be found in a paper by the authors in the *Journal of Pathology and Bacteriology*, May, 1903.

expressed views as to the essential difference between the bacillus of human and of bovine tuberculosis, and as to the consequent slight danger to the human subject from ingestion of tuberculous material of bovine origin, based his views largely on certain experiments on various domestic animals.

As these experiments are fundamental, and form part of the chain of evidence on which Professor Koch bases his views, it is important to ascertain whether different results might follow under slight modification of the experimental conditions.

Professor Koch, at a later period, published the details of the experiments on which he based his views. We have recently come into possession of these detailed reports, and find that the results obtained by us in the case of the pig, especially by subcutaneous injection, differ materially from those obtained by him. Professor Koch, using two pigs, was unable to produce infection with the human bacillus by subcutaneous inoculation.

In our experiments, on the other hand, the six animals employed were all infected with the human bacillus, and the character of the infection was at least as severe as that described by Professor Koch as the result of inoculation of the pig with the bovine bacillus.

Professor Koch employed pure cultures of the bacillus, while in our experiments tuberculous sputum was used.

The difference in the results obtained is probably to be attributed to this fact, in which case the greater infective power of the tuberculous sputum may be due to various factors, *e.g.*:

1. In the sputum the bacillus probably retains its original virulence, and has undergone no modification, as may be the case on cultivation.

2. The associated organisms, or their products in the sputum, may assist in the process of infection.

We are aware that Professor Koch's experiments are comparative, but when the numbers used are so small—two animals for subcutaneous inoculation with human tubercle bacilli and two with bovine tubercle bacilli—and when only one race of each type of bacillus is used, grave risks of error are incurred. One of these may be indicated—namely, that the race of human tubercle bacillus employed may have been one of comparatively low virulence.

With reference to the experiments on feeding with tuberculous

sputum, Professor Koch obtained some form of infection in three of the six animals employed by him.

In our feeding experiments only three pigs were used, and all contracted a local, but very definite, infection, with great wasting, followed by death. The tuberculous lesions appeared hardly sufficient to account for death or for the emaciation; but it is to be noted that the animals were somewhat younger than those employed by Professor Koch, and that the feeding was commenced at the period of weaning, when young animals are liable to catarrhal intestinal disturbances. Moreover, the sputum employed, having been sent by post, was usually twenty-four hours old, and contained numerous putrefactive organisms and their products.

INOCULATED SUBCUTANEOUSLY WITH SPUTUM.

No.	Weight.	Sputum.	Died.	Killed.	Number of Days.	Weight.	Lesions.
	lb.	Patient.				lb.	
1	29½	S.	...	+	227	56	Tubercles, local; bronchial and mediastinal glands, lungs, liver.
2	30	R.	+	...	137	24	Tubercles, local; abscesses, inguinal and lumbar glands, lung, liver, spleen.
3	19	R.	+	...	47	16½	Tubercles, local; lumbar and bronchial glands, lungs, liver, spleen, kidneys.
4	58	H.	+	...	102	70	Tubercles, local; lumbar glands, lungs.
6	20	H.	+	...	146	24	Tubercles, local; inguinal and lumbar glands, lungs, liver, spleen.
7	35	H.	+	...	31	24	Tubercles, local; inguinal and lumbar glands, lung.

FEEDING WITH SPUTUM.

No.	Weight.	Sputum.	Died.	Killed.	Number of Days.	Weight.	Lesions.
	lb.	Patient.				lb.	
8	35	H.	+	...	82	26	Tubercles, tonsillar and cervical glands.
9	30	H.	+	...	72	23	Tubercles, tonsillar glands.
10	36	H. J. S.	+	...	78	26	Tubercles, tonsillar and cervical glands.

LATENT SCARLET FEVER AND ITS IMPORTANCE EPIDEMIOLOGICALLY.*

BY

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(*Translated by Staff-Surgeon O. W. Andrews, R.N.*)

EVERY medical man knows that there exist certain abnormal types of scarlet fever. It is a difficulty which very frequently arises. Under such circumstances, the case may be one with an incomplete or discrete eruption, or without any rash at all, in which the pharyngeal phenomena, the desquamation, and the fever may be all precisely similar to normal cases of scarlet fever. Take, for example, the ill-defined variety (*forme fruste*) of Trousseau, which, says M. Moizard, "must be diagnosed first by the state of the throat, then by the tongue, and it is only by these that the physician can form an opinion." In fact, this variety of scarlet fever is often difficult to diagnose.

Military medical officers, on the other hand, and more especially since the publication of the works of MM. Kelsch, Colin, Chauvel, and Vaillard, know that a considerable number of sore throats precedes, accompanies, and follows epidemics of scarlatina, and that these sore throats, which are very often white throats, are only attenuated forms of scarlet fever, *Scarlatinæ sine Scarlatinis* (Gubler). These forms are frequently met with, and are well known.

But if the scarlatina without a rash (the *scarlatine fruste*) has often been observed and studied, it is not so with certain other varieties, upon which, up to the present, authors have dwelt very little. The *scarlatinette* of Roger is very little known; the *scarlatina without fever* has scarcely been studied, since Barthez and Rilliet, Fiessinger (d'Oyonnax), and M. Couatarmanach, at the suggestion of M. Moizard, first drew attention to it.

As for the *latent scarlatina*, it has only been considered by the classical authorities as a visionary idea without serious foundation.

It is this latent scarlatina which it is my intention to study

* From *La Semaine Médicale* of June 24, 1903.

to-day. A little epidemic which arose towards the end of last year at the l'Orphelinat Militaire Hériot (which included altogether eighteen cases, of which three were latent) will afford the opportunity, and, thanks to observations which I collected whilst it lasted, I shall be able to draw your attention to some of the features of the latent form; to show afterwards that it is not at all mysterious or incomprehensible, but that it is only a degree inferior to the already known attenuated forms; and, finally, I shall point out briefly its rôle epidemiologically.

The idea of latent scarlatina goes back to Graves and Trousseau. These two celebrated clinicians of the last century had noticed that in certain cases patients who had never been known to have suffered from scarlatina were found to be suffering from complications which are characteristic of this affection, such as hæmaturia connected with nephritis, anasarca, or purulent pleurisy. They concluded that the patient had had a latent attack of scarlatina—*i.e.*, a scarlatina which does not show itself by any symptoms, but nevertheless infecting the body in a manner sufficiently profound that complications of the disease might occasionally supervene.

Notwithstanding the authority of its introducers, latent scarlatina had no success. And in fact the problem set in this way was indeed difficult to solve; and this singular affection, without symptoms and without any revealing signs, but not without later effects, resembled a little too closely one of those creatures of the mind that formerly the scholastic element sowed broadcast, and which the more matter-of-fact medical generation which Trousseau taught should regard with a certain amount of mistrust.

Yet Graves and Trousseau were right, and I shall show further on that the denial of the existence of latent scarlatina is the result of a misunderstanding, or, rather, of a too literal translation of an epithet to which one has given some vague, mysterious meaning. If in place of calling it latent scarlatina one had called it, for example, very attenuated scarlatina, or else non-febrile monosymptomatic scarlatinette, this abnormal form would have been accepted without any opposition, and the knowledge and study of it might probably have well led to the avoidance of errors and pitfalls by epidemiologists; because if there is one eruptive fever whose propaga-

tion may have remained obscure and misleading in many cases, it is scarlatina.

There is reason to hope that the idea of latent scarlatina will help to solve some of the puzzles of clinical medicine and epidemiology, and I believe that after having deprived this variety of its mysterious appearance, and after having shown its relationship to other attenuated forms, nobody will hesitate to grant it a small place amongst the abnormal varieties of scarlatina.

As a general rule, we know very little of attenuated forms of disease. It would seem that it is only the severe cases and the extraordinary complications which have the power of interesting clinical observers, and the descriptions of disease, as a rule, dismiss these commonplace cases in a few lines as "febriculæ." The reason appears to be a very simple one: if the attenuated forms (without fever and *a fortiori* the latent kind) are so exceptionally remarkable it is because physicians only see people at their homes who are sick, or only receive into hospital those that are sick, whilst those who suffer from these atypical forms of scarlatina do not appear to be sick. One must, then, be placed under circumstances such as we find here in order to have the opportunity of observing them.

As the facts which I have studied are reduced in the main to a mere nothing, and as the symptomatology of latent scarlatina cannot be completely based on three cases incompletely observed, I believe it would be more interesting and more useful to state the etiology of our little epidemic, and to show the part which latent scarlatina played in it. Thus placed in its frame this last will stand out more in relief, and its contours, so vague that many eminent clinicians were unable to define them, will specify themselves and render themselves evident.

On October 24, a child suddenly showed symptoms of gastric disturbance, the prelude of a mild attack of scarlatina. The following day two other children were affected: one had an attack of medium intensity, the other a mild attack (*scarlatina fruste*).

From whence came these three simultaneous cases? One would at first suppose that some germs had survived from former epidemics, after having escaped the many disinfections and the permanent ventilation of our large dormitories (in an establishment situated in the

open country, and in a district swept throughout the year by the powerful winds of Beauce), and that one fine day these germs from former times may have again awakened into life. Doubtless one can quote some very rare examples which authors religiously hand on, *quasi cursores vitæ*. . . . Theoretically the thing is possible, but from a practical aspect, under the general hygienic conditions which are found here, I think it quite impossible, especially after an interval of thirty-two months had elapsed since the last epidemic.

Had there, by some extraordinary means, been infection of the orphan asylum through the civil population of Boissière and its neighbourhood, in which an outbreak of scarlatina had occurred in the winter and spring of 1902? But in answer to this, it must be stated, there was no communication between the Orphan Asylum and the inhabitants of the country. In the next place, the last case of scarlatina observed in the village dated from the middle of April—that is, six months before the appearance of the disease with us. Lastly, that which proves still more our independence in respect to disease around, is the fact that we did not have any scarlatina then, when there were seventy cases around us, and that in November, when it existed amongst us, no case appeared at Boissière.

The return from the long vacation took place on October 8. Were our three children infected whilst with their family? I do not think so. In the first place, the incubation period for scarlatina is short (one to five days), and it would not be likely that our patients had been actually in the incubation state during the abnormal time of at least seventeen days. Then that which absolutely sets aside this hypothesis is that one of these affected children had not been away for the holidays, and had not left the Orphan Asylum.

Unluckily, logically one is bound to admit that one of the pupils was allowed to return, who was the carrier of scarlatina unrecognised and masked, and that it was he who infected his schoolfellows.

How could it happen that this scarlatina could be overlooked? It is our custom, on the return of the children from the holidays, to examine them carefully for a fortnight, in order to try and detect measles and scarlatina as quickly as possible. Twice a day they march past the doctor, who specially examines the chest and throat.

An ordinary case of scarlatina could not be overlooked, and yet nothing was observed abnormal with our subjects. This, then, makes it quite clear that the variety of scarlatina which the child suffered from who must have infected the others was so abnormal that it failed to be recognised.

On October 13 a new pupil, aged ten and a half years, had a fit of coughing at the moment of the inspection. He was a pretty robust child. He did not complain of anything at all; he ate as usual, but simply stated later on that he had had a slight headache for two days at the period we were examining him. The child undressed himself, and I happened to remark out loud that the skin of the trunk was slightly rose-coloured, adding at the same time that with sandy-haired individuals and with a very fine skin, as was the case here, exposure to the air was enough to sometimes cause this coloration. I ought to have remembered these words a few days later. In the face of the good general health of the child, the complete absence of sore throat (the pharynx had been examined), the absence of all fever, and the vigorous and active appearance which he had, the idea of scarlatina never occurred to me any more than during the following days, because morning and evening I examined him, looked at his throat, etc. The good state of general health which he appeared to enjoy did not contradict it for one instant. Examined very carefully still later, I noticed the disappearance of the slight rose coloration of the body, but I did not discover any trace of desquamation from the tongue or skin, no modification of the lingual papillæ, etc., and, besides, the child was not indisposed for a single instant.

From October 15 to 17 two boarders had a little sore throat, and one of them was the very next neighbour in class and dormitory to the preceding case. Although these children were both subject to frequent attacks of tonsillitis, they were put under observation. One had during two days a slight attack of fever; the throat was red, the tonsils a little enlarged, but everything rapidly returned to the normal state, and as the scarlatina did not show itself by any evident symptoms, he was soon released. The other child had a slight turgescence of the left tonsil, with a little redness of the back of the throat. He had no fever, but seemed a little out of sorts for

a few days. Further, very careful examination did not afford us anything definite. Finally, as I have already said, three cases of scarlatina, clearly recognisable, showed themselves on the 24th.

It seemed to me beyond a doubt that the pupil examined on October 13 was the carrier of a *latent scarlatina*, but the question at once arises, Where had he been infected? The Mayor of the district where the child had previously resided certified to me that there had not been any scarlatina in his commune or in the neighbourhood during the months of July, August, and September. In carrying out, then, the inquiries in the different places where our subject could have stopped during his journey as far as Boissière, I arrived at the certainty that on October 7 he had stayed and slept at Epernon, where he had gone into several houses, and that in this little town there had been for some few days numerous cases of scarlatina. For reasons, difficult to determine (diminished virulence of the infecting agent, excessive resistance of the subject, etc.), he had suffered from a benign form, ambulatory and latent, which, as far as could be observed, showed itself by a slight headache for two days, an eruption not sufficiently obtrusive to attract the attention of the medical man, and perhaps there was a slight pharyngo-laryngeal irritation, which showed itself by a slight cough. It would be imprudent to assert that these symptoms were the only ones, but they were the only ones which were noticed, and in this case, even more so than in scarlatinette and scarlatina without fever, there was a complete disappearance of the general phenomena.

Nevertheless, the extreme attenuation of the symptoms did not prevent the affection from being infectious. Very probably it was transmitted to the two cases of sore throat seen on the 15th, and of which one was, as I have said, the very next neighbour in class and dormitory to this little patient, and these two children both had to the same extent a masked attack of scarlatina, different, however, from that from which it sprung; for, as I have remarked, the one had a sore throat with moderate fever (temperature 101·1° F.) for forty-eight hours, the other had a little turgescence of the left tonsil, with a slight redness at the back of the throat, and if he did not have fever, he was at any rate during some few days a little out of sorts.

Unquestionably, later examinations have not allowed me to verify the diagnosis of our three patients by means of desquamation of the tongue or of the skin; but, taking into consideration the general mildness of the symptoms, this does not surprise me. During this epidemic the desquamation of the tongue failed to occur pretty often in cases which were beyond a doubt (with a third of the patients); with two-fifths the peeling of the skin was very slight, even insignificant, notwithstanding the confluence of the eruption. There is, then, no ground for attaching an exaggerated importance, from a diagnostic point of view, to the absence of these signs.

Lastly, these three latent cases have been the starting-point of the little epidemic already mentioned, which included fifteen other cases, almost all of which were remarkably mild. *Latent* scarlatina is not, therefore, an imaginary state of things.

Graves and Trousseau have admitted it; but, despite the weight of their great reputation, the vast majority of clinicians have remained sceptical. It seems, in fact, extremely difficult to accept the hypothesis of scarlatina, in which there is neither fever, nor rash, nor peeling, nor sore throat, and of which one can only presume a prior existence by the appearance of one of the later complications of scarlatina. "Notwithstanding the authority of such masters," says M. Moizard, "I declare that these facts seem to me very hard to explain, and that in every case the opinion held by them is open to discussion."

I believe that the opposition of authors arises from this term "latent," and that Graves and Trousseau employed it in quite a special sense, and one which seems to me inaccurate. It must not be called latent scarlatina, but *masked* scarlatina, unrecognised on account of the extreme attenuation of its morbid phenomena.

If chance had not made me strip the child examined on the 13th, I should not, in making the inquiry after the appearance of the first confirmed cases, have ever suspected him of scarlatina, because his general condition appeared so absolutely satisfactory. And yet the body was covered by a scarlatina rash, evidently very pale, but sufficiently visible that I should have noticed it without recognising it. On the other hand, the two cases of sore throat of the 15th (and for the reasons I have given above) seem also most probably

to have had latent scarlatina, which in one case showed itself by the occurrence, altogether very slight, of sore throat with fever, and in the other by an isolated swelling of one tonsil, and by the debility which followed it. One can, then, always maintain, apropos of cases called latent, recorded by Graves and Trousseau, that an examination under more favourable conditions, and at a date more nearly approaching the commencement of the illness, would have enabled the discovery of one of the cardinal symptoms of scarlatina, be it as attenuated as it might.

After all, if the latent form of scarlatina, in the *special* sense in which the two famous clinicians of the last century understood the term, may appear hypothetical, at any rate the existence of an ambulatory form with phenomena attenuated to such an extent that the subject appears to be in his normal state of health seems to me to be indisputable, and the importance of this form for the prophylaxis of the disease should not be overlooked.

(*To be continued.*)

THE VALUE OF SANATORIA.

It is more than ever certain that the social prophylaxis of tuberculosis is effected by the creation of good hygienic conditions, which deprive pathogenic organisms of the medium suitable for their multiplication. The whole question is discussed in "Cosmos," by M. P. Goggia, who gives statistics dealing with the results in Germany of seventy-two popular sanatoria, in which annually some 30,000 cases, mainly belonging to the lower ranks of society, receive treatment. The average duration of the time the patients remain under treatment is about three months. Of 424 patients admitted into one sanatorium with signs of early pulmonary tuberculosis, it was found that 94·7 per cent. could work at the end of six months, 80·3 per cent. at the end of two years, 66·7 per cent. at the end of three years, and 44·4 per cent. at the end of four years. Seventy-two patients who were three months in a sanatorium gave 35 per cent. cured, while of fifty-five who were treated as ordinary out-patients 52·7 per cent. were cured. The short time that the working classes can afford to spend in sanatoria is without much direct beneficial influence on the disease, though it is possible that they may during their stay in a sanatorium acquire a knowledge of hygienic principles which they might acquire as easily and in a less expensive manner if a national system of education was efficiently organized in the matter of hygienic teaching.

SUPPLY OF STERILIZED HUMANIZED MILK FOR INFANTS.*

BY

A. A. MUSSEN, M.D., D.P.H. CAMB.,

Assistant Medical Officer of Health to the City of Liverpool.

DURING the past eighteen months Liverpool has been honoured by many deputations and visitors from British and foreign towns, who came for the purpose of seeing, and obtaining information with regard to the method of supplying sterilized milk for infants which the Liverpool Corporation have established in the city.

Some of these towns contemplate starting on similar lines, and others will undoubtedly wish for information on the matter. The present, therefore, appears to be a most suitable occasion for the subject to be discussed, and I have done my utmost to secure the co-operation of those who have had any practical experience in the work, in order that members of the Congress may have every opportunity of forming an opinion on the merits of the system.

A very large number of books and articles have recently appeared on infant feeding, and the subject has been thoroughly investigated from every point of view by the most skilled observers. Without going into the details of these exhaustive observations, we can deduce two important conclusions from them:

1. All authorities are agreed as to the enormous advantages which infants who have been fed on their mother's milk possess over those who have had to depend on artificial nourishment. No food, however scientifically prepared and carefully administered, can efficiently take the place of the child's natural sustenance.

2. In those cases, which, unfortunately, are very numerous, where the infant is deprived of its natural food, cow's milk suitably modified so as to imitate the composition of human milk is the most suitable food during the first twelve months of life.

The question, therefore, which the originators of this system set themselves to solve is, how to provide infants of the poorer classes,

* A paper read at the Liverpool Congress of The Royal Institute of Public Health, 1903.

who have been deprived of their natural food, with a supply of milk suitably modified and graduated according to age, and delivered in such a way as to protect it from contamination in their homes.

Their solution is this: Having procured a sufficient quantity of pure milk, it is modified by the addition of water, sugar, and cream, in such quantities as to make it approach as near as possible the composition of human milk. The requisite amount for each child, for twenty-four hours, is then divided into nine parts and placed in nine bottles. The contents of each bottle is just sufficient for one meal. The bottles and their contents are then exposed to the action of steam, which destroys the larger number of bacteria present, and the bottles are afterwards sealed by means of a spring stopper. In order to feed the child, it is only necessary to open the bottle after having warmed it, place an indiarubber teat on it, and feed the child through it. The chance of the milk becoming contaminated is therefore reduced to a minimum.

What I propose to do is merely to give a short account of the system which has been instituted on these lines by the Health Committee in Liverpool, and also a few reasons why we are of opinion that it is a distinct benefit to the community, and a very important step in the education of the public on the question of infant feeding.

The history of the movement is, briefly, as follows: In 1894 a philanthropic association in Fécamp, under the direction of Dr. Dufour, established what is known as "Gutte de lait," in order to supply sterilized humanized milk for infants whose mothers were unable to suckle them. The success which attended it very soon induced Havre and other French towns to follow the example.

In England, the first town to take the matter up was St. Helens, in 1899, and Liverpool followed in 1901.

To begin with our first effort: This was made at Netherfield Road, in the centre of a very populous district, where during the hot weather the deaths from diarrhœa were always very numerous. When ordering the plant for this depot, we did our best to find some firm who had experience in this class of work, but failed; consequently a large part of the work was experimental, and had to be altered. Nevertheless, valuable service has been done by it, and it

will repay a visit, as showing the difficulties with which we had to contend.

Some two months after the Cazneau Street Depot was opened. This is about three-quarters of a mile from Netherfield Road, and is used merely as a distributing depot.

The number of people anxious to obtain the milk had now increased so much that the Committee determined to open another depot in the south end of the city. This has been done in Earle Road. Here, most of the mistakes made in the former attempt were avoided, and the general opinion is that the work is carried out with the smallest amount of inconvenience, and expeditiously. I shall therefore confine my description to this depot.

The milk is supplied by contract from both town and country shippons, and samples of it are taken on delivery from time to time for chemical and bacteriological analysis. When it arrives at the depot, as a routine practice, a sample is taken for the purpose of estimating the amount of fat by Gerber's test; a sample is also placed in the cream-tube. The milk is measured into cans, and placed in a large fixed circular receptacle. A certain amount of water, sugar, and cream, is then added, according to the following formula:

FORMULA USED FOR MODIFICATION OF MILK.

Age.	Quantity of Pure Milk for Twenty-four Hours.	Water.
	Ounces.	Ounces.
One to two weeks - - -	6¾	6¾
Two to eight weeks - - -	13½	13½
Two to three months - -	20¾	10½
Three to five months - - -	30	15
Five to seven months - -	36	12
Over seven months - - -	36	12

2½ ounces of cream, 1½ ounces of sugar, and ⅛ ounce of salt, to be added to each gallon of mixture.

This receptacle is fitted with a draw-off pipe at the bottom, which passes through the floor, by means of which the mixed milk is

supplied to the bottle-filler. This machine for filling the bottles with the exact amount of the mixture required has been the most troublesome part of the machinery to obtain.

The essential requirements of a filler we soon found to be—(*a*) Fairly accurate in filling the bottle with certain quantities; (*b*) easy to manipulate rapidly; and (*c*)—perhaps most important of all—easy to clean. We have now a machine which fulfils these requirements fairly well.

It consists of a reservoir for the milk, into the bottom of which nine tubes are fixed. These lead into a similar number of cylinders, the capacity of which can be varied by means of a movable piston. A two-way tap is placed in each tube, between the reservoir and the cylinder. When the tap is in one position, it allows the milk to flow into the cylinder until it fills; then the tap is turned, and the milk flows out of the cylinder down another tube into the bottle placed underneath to catch it.

It fills the bottles very accurately. It can be worked rapidly and with ease, and it is fairly easy to take down and clean. All the tubes are straight, and all that is necessary is to run a brush through each a few times and scrub the loose parts with soda and hot water, in order to clean it effectually.

Our bottles and stoppers have also gone through various stages of evolution. We understood, when starting the first depot, that the wire and the fixed stoppers were inconvenient. We therefore employed a china stopper with a rubber ring, the idea being that on heating the bottle the air would be expelled, and after cooling a partial vacuum would be formed which would draw in the stopper and seal the bottle. This method, however, was found to be unreliable, and the same may be said of the rubber cap, although it was certainly an improvement on the former.

We have therefore settled that the present spring stopper attached to the bottle is the most reliable and convenient. The bottles, when they are returned to the depot, are put into hot water, and are cleaned thoroughly by a revolving brush driven by a small steam turbine. This insures that the dried milk curd on the inside of the bottle is removed. They are afterwards placed mouth downwards on a jet of water, which rinses any dirty water out.

The bottles are now placed on trays holding 240 each, which run on rails first under the bottle-filler, where each bottle receives its proper amount of milk, and are subsequently wheeled into the sterilizer.

The sterilizer is an oblong chamber covered with non-conducting material, 9 feet long, 5 feet broad, and 18 inches deep, and holds four trays with 240 bottles each. The doors are screwed down, and steam is turned on from the boiler. The air is allowed to escape before shutting the outlet. The temperature rises to 210° F. in about thirty minutes, and this temperature is maintained for twenty to thirty minutes. The trays are wheeled out, and then taken upstairs by means of a lift. The bottles are then placed into wire baskets ready to be taken away.

When the mother or the person in charge of an infant comes to get the milk, she frequently brings the infant with her, in which case the name and address are entered, and a few particulars as to the family history of the child, such as, the number of children in the family; how many dead; what they died of; has this child been healthy up to the present? if ill, what is the matter? did a doctor recommend the milk? The child is then weighed, and a card of instructions is given to the mother.

Instructions.

1. The cost of the full weekly supply of humanized milk for infants is 1s. 6d. and 1s. 9d., payable in advance. If a day's supply only is taken, the charge is 3d. to 3½d.

2. The person using the milk guarantees to use the same regularly during the needs of the child, and to send for it at the stated hours.

3. The milk will be supplied in nine bottles in a basket, each bottle containing sufficient milk for one feed, according to the age of the child.

4. Just before using, each bottle should be placed, unopened, in a basin of warm water, and warmed to the proper temperature. The bottle should then be opened and the teat inserted. It is recommended that the infant should be fed every two hours during the day, and every four hours during the night.

5. When all the milk in one bottle is not used, the remainder

must not be warmed up again for the infant, but a fresh bottle opened for its next meal. This milk will be found to be quite sufficient if given regularly.

6. Every person using the milk will be supplied with two teats, which must be kept clean, and brought to the depot for inspection every Friday.

7. After using, the bottle should be thoroughly rinsed in water.

8. Breakages will be charged for at the rate of 1d. per bottle, and damage to baskets must be made good.

9. If children are sent for the milk, they must be warned not to tamper with the stoppers of the bottles.

10. The presence of infectious disease (including scarlet fever, whooping-cough, measles, diphtheria, small-pox, chicken-pox, and typhoid fever) in a house must be at once notified to the Medical Officer of Health.

11. The child must be brought once a fortnight to be weighed.

12. Should the milk not be agreeing with the child, the matter should be reported at once.

A basket is given containing nine bottles, which is sufficient for twenty-four hours, and also two teats. The mother or guardian is told how to feed the child, and the card of instructions is explained to her. If the child is not brought on the first visit, the milk is supplied on condition the mother brings it to be weighed at the earliest opportunity.

We occasionally have trouble with the very ignorant class, who will persist in decanting the milk out of the sterilized bottle into one with a long tube. For the purpose, therefore, of seeing that the milk is properly used, the lady inspectors visit from time to time the houses where it is likely that the milk is misused. Also in cases where the mother says the child does not like the milk, or does not appear to be thriving on it, a visit is paid, and if a doctor is not in attendance the mother is advised to call one in.

The charges made for the milk have been revised from time to time. On starting, the charge for a day's supply—that is, nine bottles—was 2½d., or if paid in advance for the week it was 1s. 2d. Subsequently it was increased to 1s. 6d. a week, and later a difference

was made between infants under four months and over four months —1s. 6d. a week for the former, and 1s. 9d. a week for the latter.

A study of the case-books, in which the particulars of each case are entered, and in which the progress of the child, so far as can be ascertained, is recorded, reveals many interesting facts. The first thing that strikes one is the very large number of children who are described as suffering from some form of sickness on admission; in fact, over 50 per cent. of those entered are stated by the mothers to be ill. A history that is frequently given is that almost everything in the way of infant's food has been tried without any satisfactory result, and they have now come to the depot as a last resource. A large number of these infants are recommended to try the milk by the medical attendants both in hospital practice and private practice, and they report excellent results in cases where it is used. We are especially indebted to the members of the staff of the Children's Infirmary for their hearty co-operation and many valuable suggestions that they have made from time to time. I might mention that at present a proposal is under consideration to establish a distributing depot in connection with the out-patients' department of the Children's Infirmary, so as to bring the two institutions into closer contact with each other and to be a source of mutual assistance.

Since the opening of Netherfield Road Depot in 1901, about 5,000 infants have been fed on the milk, for periods varying from a few days to twelve months and over; the average number being supplied at any one time is about 800.

Every effort is made to induce the mothers to bring their children to be weighed at least once a fortnight. It is difficult, however, for some to do so, owing to the distance at which they live from the depot, and some are indifferent. A considerable number, however, take a keen interest in their children's progress, and bring them more or less regularly to be weighed. It will be readily understood that under these circumstances it is a difficult matter to compile statistics that will give a correct idea of the value of the results obtained. I have, however, in the accompanying diagram collected all the cases that have been in the books for three months and over, and that have been fairly regularly weighed during

that period. These have been divided into groups according to the age at which they were first weighed (not on admission, as some of the infants, chiefly among those under one or two months, were supplied with the milk for a week or more before being weighed). The gain in weight of each child was tabulated, and an average taken, which is compared with a table giving the average weights of healthy children during the first twelve months of life. The dotted line in the diagram gives approximately the average increase in weight of a healthy child naturally fed.

The total number of children included in the diagram is 360, and this represents about 50 per cent. of those who have used the milk for over three months. No attempt has been made to select the cases, but all the infants have been included whose progress, whether good or bad for that time, could be ascertained. It may therefore be considered a fair indication of their general progress. When one considers that the average weights of the infants when admitted were far below the average of healthy infants of the same age, and also that a considerable percentage of them were seriously ill when admitted, the result appears to me to be very satisfactory.

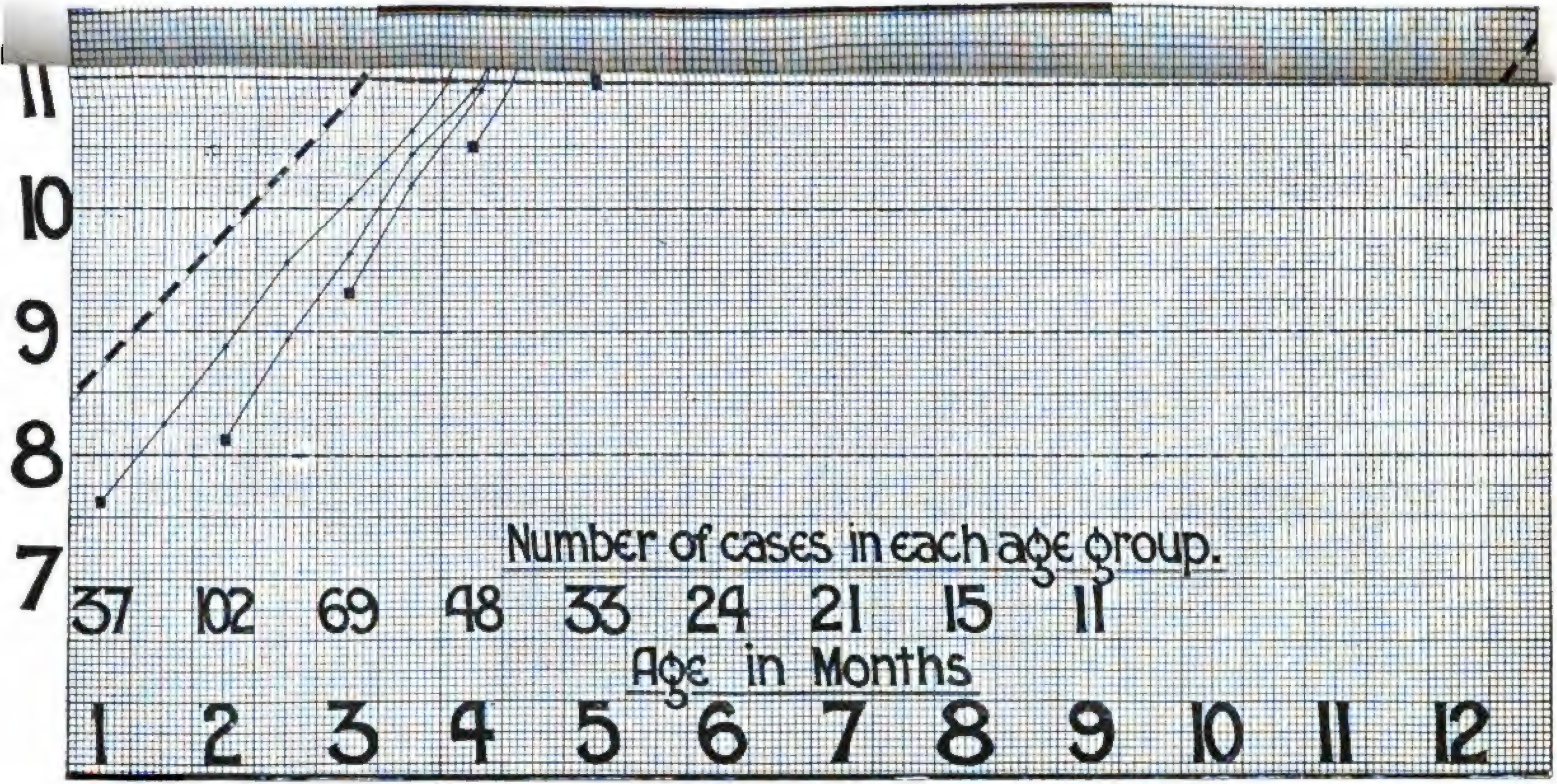
The evidence afforded by personal inquiry from private sources should also be referred to, such as statements of medical men, both with regard to individual infants fed on the milk, and their general observations as to the marked improvement following on its use are strong recommendations for its adoption. Nor can one ignore the number of letters and communications which have been received from parents and guardians emphasizing the value of the milk, and the boon it is to those who are compelled to bring up infants on artificial nourishment.

Comparisons have been made between this method of supplying humanized milk and the clinics or consultations for children provided in Paris, rather to the disadvantage of the former. In these clinics each child is especially examined by a doctor, and mothers are compelled to bring their children regularly once or twice a week to be weighed and inspected, otherwise they are deprived of the milk; and our critics therefore urge that humanized milk should not be given except under strict medical supervision.

No one, of course, questions the desirability of medical super-

AVERAGE WEIGHT OF INFANTS

ON STERILIZED MILK FOR THREE MONTHS OR OVER.



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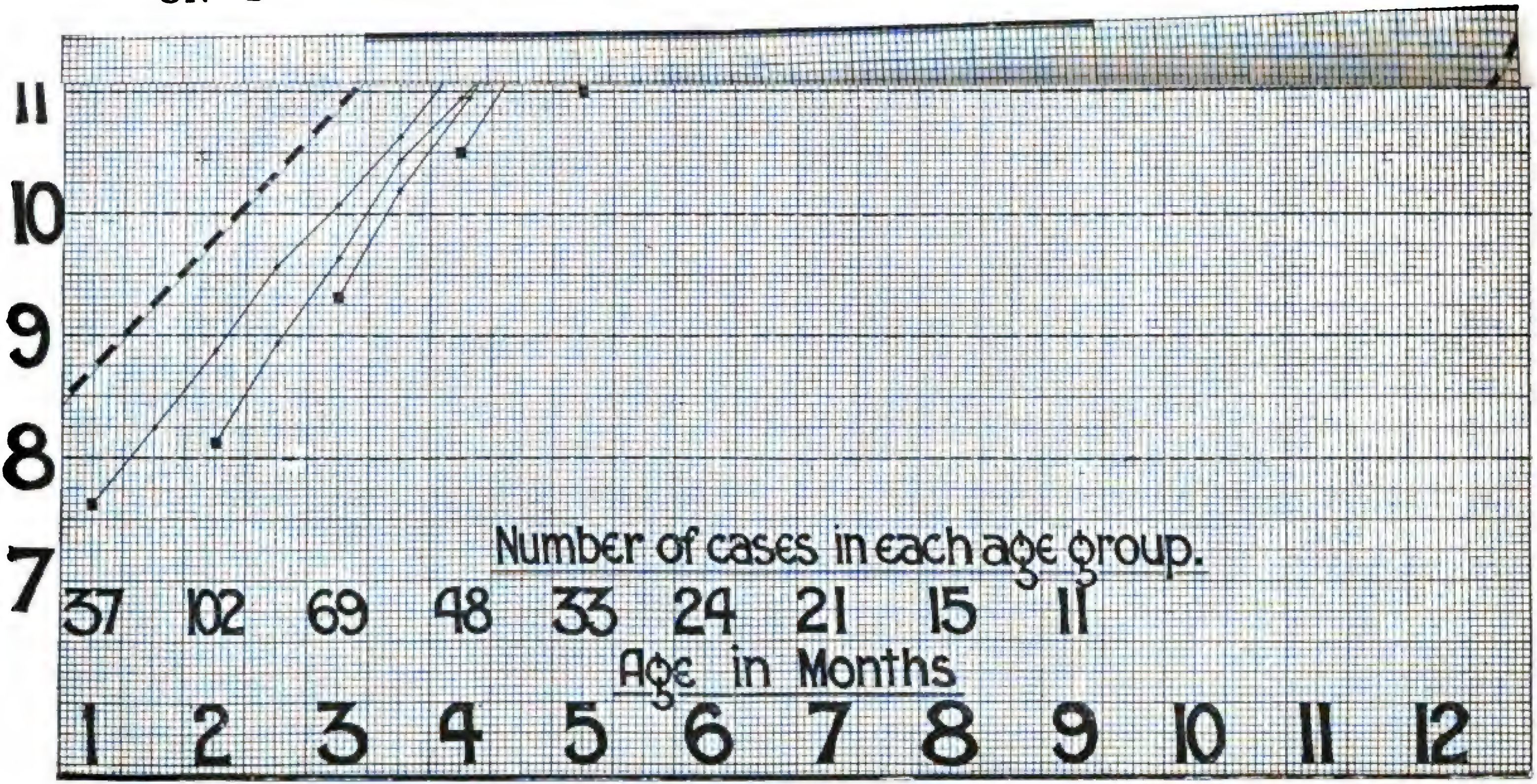

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vision, and we should be among the first to encourage these people to solicit medical advice; but we also know that the class with which we have to deal will not do so until serious, and often irreparable, damage has been caused to the health of the infant.

The question appears to narrow itself down to, What would these infants be fed on if they did not get this milk?

Few, I think, will deny that the present conditions under which the vast majority of infants are artificially fed are highly unsatisfactory, and that the fluid prepared by the mother, or more frequently by one of the elder children, and intended to contain the necessary nourishment, rarely contains more than 1 per cent. of fat, and is absolutely loaded with micro-organisms of all kinds.

In reply to this, our critics urge that it is only necessary to provide a supply of pure milk, and insist on a standard of bacterial purity.

Doubtless a great deal can be done in this direction, and, as a matter of fact, very few Sanitary Authorities in England have done more than the Liverpool Health Committee to improve and protect the milk-supply of the districts over which they exercise control; but we cannot admit that to be sufficient, for even supposing that the milk arrived at the house pure, a few hours kept under the usual conditions would suffice to contaminate it, and even after that it would not be properly used.

Our critics further argue that public money would be better spent on health visitors to teach mothers the proper method of feeding infants, instead of supplying humanized milk. In answer to this, I should like to point out, that the Liverpool Health Committee were one of the first authorities to appoint lady inspectors for this purpose, and a large amount of good has resulted, but we know how difficult it is to instil into the lower classes even the most elementary habits of cleanliness. How much more difficult is it to teach them the rationale of careful infant feeding! Medical men will tell you that even among the educated classes the vast majority of infantile troubles are due to improper feeding. Besides, I consider this system to be one of the best instruments yet introduced for the education of the people on this point. It develops a habit of accuracy and regularity in feeding, does away with the idea of the

necessity for patent foods and long tube bottles, and brings before the mother in a forcible and convincing way the importance of cleanliness in dealing with milk.

In conclusion, I am convinced that we are working on a sound and logical basis, and that until our milk-supply is produced and delivered in an absolutely pure condition, and the general public have intelligence enough to appreciate the rationale of infant feeding, a system founded on these lines will play a very important part in future preventive measures against infantile mortality.

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DISCUSSION*

ON

"THE NATURE OF THE SO-CALLED PSEUDO-DIPHTHERIA (HOFMANN) BACILLUS AND ITS SIGNIFICANCE (IF ANY) IN THE BACTERIOLOGICAL EXAMINATION FOR DIPHTHERIA."

I.

PAPER

BY

LOUIS COBBETT, M.D., F.R.C.S.

THE bacillus of Hofmann must be clearly distinguished from the *non-virulent* diphtheria bacillus, which, like its virulent namesake, forms acid out of glucose. Under no circumstances does Hofmann's bacillus produce any acid. In its usual form, when grown on alkaline serum, it is easily recognised, being a short bacillus with rounded ends, one unstained septum in the middle, and no polar bodies. Occasionally, however, when grown fresh from the human throat, it is longer and split up into segments by several unstained septa. It is then difficult to distinguish from the diphtheria bacillus, though Neisser's stain, or my modification of it, practically removes the difficulty. It is to this occasional form of the bacillus of Hofmann that the name "pseudo-diphtheria bacillus" is properly applied. It is known to be a true Hofmann because it always reverts in sub-culture to the typical form, and has all the other characters of this bacillus. Hofmann's bacillus is an exceedingly common inhabitant of the mouth—not, indeed, in its pseudo-diphtheria form, which is fortunately rather uncommon, but in its typical form described above. Under these circumstances it offers no difficulty to those who are practised in examining cultures from the throat.

In my experience† it occurs in about 36 per cent. of children from the public elementary schools. In those of the richer classes and in

* At the Liverpool Congress of The Royal Institute of Public Health, 1903.

† For reference to this and other of the writer's statements which follow, see *Journal of Hygiene*, vol. i., pp. 235, 485.

adults it is much less frequent. It is no more often met with in the brothers and sisters of diphtheria patients than in other children attending the same school, nor is it any less common in children belonging to a healthy district than in those who live in a neighbourhood where diphtheria is prevalent.

So common a bacillus is naturally present in many convalescents from diphtheria; but in these circumstances it is quite as free from virulence for the guinea-pig as when obtained from healthy persons (eighty-six cultures of Hofmann's bacillus tested, many from convalescents), and has no tendency to form acid. On the other hand, diphtheria bacilli, as they gradually disappear from the convalescent, retain their virulence to the end (four cases, three tested three times each, one tested six times).

I do not wish either to affirm or deny that the *Bacillus diphtheriæ* may become attenuated. I have, of course, frequently met acid-forming bacilli morphologically identical with the diphtheria bacillus, but completely devoid of virulence for the guinea-pig, and I accept the general belief that these are attenuated diphtheria bacilli. In my experience these non-virulent diphtheria bacilli have occurred once in a person convalescing from diphtheria, and once they have been found during the acute stage of the disease, but they have been far more commonly seen in contacts, and, like the true diphtheria bacillus, have never been found in any of the persons examined by me, who have not been in contact with cases of diphtheria.

While willing to believe that under certain circumstances the bacillus of diphtheria may become attenuated, I think it remarkable that, among seventy-nine cultures recently tested at Cambridge, none were found with a low degree of virulence (0·1 c.c. of a twenty-four or forty-eight hour broth culture, subcutaneously injected, always* proved fatal to guinea-pigs within two or three days). It seems probable, therefore, that attenuation does not occur very frequently. On the other hand, among the eleven non-virulent diphtheria bacilli tested none were found to kill guinea-pigs in doses of 2 or 4 c.c. of a forty-eight hour broth culture.

Eighty-six cultures of Hofmann's bacillus were tested, the majority

* Except in the case of four, where the smallest dose used was 0·5 c.c.

of which came from contacts or convalescents, none possessed any virulence for the guinea-pig (in doses of 2·0 or 4·0 c.c. of a forty-eight hour broth culture).

Hewlett and Knight* claimed in 1897 that they had succeeded in changing a diphtheria bacillus into the pseudo-diphtheria bacillus which formed no acid (Hofmann) by heating, a method which in the hands of Roux and Yersin† had transformed a virulent diphtheria bacillus into an *acid-forming* pseudo-diphtheria bacillus. They admit that they were not so successful with other attempts, and although in two instances, after heating diphtheria bacilli, pseudo forms were obtained, the changes were not nearly so complete as in the first instance. On the other hand, they believed that they had in one or two cases succeeded in converting the bacillus of Hofmann into the virulent diphtheria bacillus by cultivating on serum. Richmond and Salter‡ also believe that they have converted Hofmann's bacillus into the bacillus of diphtheria, and this they did by passing it through small birds, for which the bacillus of Hofmann is said to be pathogenic. They also state that Hofmann's bacillus produces products in broth culture which, when added to a neutral mixture of diphtheria toxin and antitoxin, renders the latter capable of killing animals with the symptoms of diphtheria toxæmia. In other words, that one of its products is a substance which combines with antitoxin, and liberates some of the toxin in neutral mixtures—in fact, no other than the diphtheria protoxoid of Ehrlich. The products of seven Hofmann bacilli have been tested in this way by me, but without finding that they had any action on a neutral toxin-antitoxin mixture. Moreover, in a limited number of experiments with small birds, he had no success in attempting to convert Hofmann's bacillus into the bacillus of diphtheria.

The instances of the supposed conversion of Hofmann's bacillus into the diphtheria bacillus are too few to be convincing. Moreover, in these instances the Hofmann bacillus has always been taken from a convalescent case of diphtheria, and the possibility has never

* Hewlett and Knight, Brit. Inst. Prev. Med., 1897.

† Roux and Yersin, *Ann. Pasteur*, 1890, vol. iv., p. 385.

‡ Richmond and Salter, *Guy's Hospital Reports*, vol. liii., p. 56; and Salter, *Dr. Jenner Inst.*, 2nd Series.

been absolutely excluded that a few diphtheria bacilli may have been stowed away with the original Hofmann.

The bacillus of Hofmann is not agglutinated by a serum which acts on the diphtheria bacillus.

It is possible to produce a serum (for which purpose the injection of toxins do not suffice; the bacilli themselves must be used) which will agglutinate the diphtheria bacillus. Lubowski,* working in Ehrlich's laboratory, produced a serum by injecting the non-virulent diphtheria bacillus, which agglutinated both the organism used for producing it and the virulent diphtheria bacillus. It had no agglutinative action on the bacillus of Hofmann.

In conclusion, the bacillus of Hofmann differs fundamentally from the diphtheria bacillus in producing no acid out of glucose. It is very widely distributed, no commoner in contacts with diphtheria than in persons from healthy districts. Even when taken from convalescents, it never has any virulence for the guinea-pig. It is not agglutinated by a serum which agglutinates the diphtheria bacillus and the non-virulent diphtheria bacillus. It forms neither toxin nor toxoids. The published instances are too few to prove the conversion of Hofmann's bacillus into diphtheria bacillus, and *vice versâ*. There are, then, no sufficient reasons for concluding that the bacillus of Hofmann has any relation whatever to diphtheria or the diphtheria bacillus, the latter becoming, in all probability, when attenuated, converted, not into Hofmann's bacillus, but into what is now generally called the non-virulent diphtheria bacillus, retaining its power of forming acids out of suitable sugars.

II.

PAPER

BY

JOHN C. HEAVEN, L.R.C.P., D.P.H.,
Deputy Medical Officer of Health for Bristol.

I VERY greatly regret that I am not able to be present to hear the valuable opinions of the members on this question, the importance of which cannot, I think, well be overestimated. Personally, I do

* Lubowski, *Zeit. f. Hygiene*, Bd. xxxv., p. 87.

not profess to be a bacteriologist, taking the term to mean one who devotes himself entirely to that science; but I have for the past nine years been examining for diphtheria, and several thousands of specimens have come under my eye. A large number of these have been taken as well as examined by me, and the history of the families has been personally inquired into.

I venture, therefore, to put before you certain reasons in support of the conviction which has been forced upon me, that Hofmann bacillus in some, possibly not in all, cases is capable under natural, if not under laboratory, conditions of conversion into forms morphologically accepted as diphtheria bacilli, and gives rise to illness and, inferentially, to diphtheria.

That a "pseudo" has ever been converted into a virulent bacillus in the laboratory is disputed; the classical experiments in which this was claimed to have been done have failed on repetition. It seems to me, however, that one positive result outweighs any amount of negative evidence, and that failure in the laboratory is only to be expected, unless the exact conditions of the susceptible human body can there be used for culture purposes. It is here that the divergence of opinion arises between the pure bacteriologist, who only examines specimens, and who knows little or nothing of what appears to happen in the spread of disease during actual epidemics, and the bacteriologist, who himself takes the swabs, examines them, and follows up the cases, knowing what happens in the families examined.

It has been stated that Hofmann's bacillus never gives rise to clinical symptoms, but among the swabs sent in by medical men for diagnosis to the Bristol Health Laboratory there were between March 19 and June 18, 1902, no less than eighteen which yielded only Hofmann's bacillus, but which were accompanied by senders' remarks, such as "small yellow patch on tonsil"; "two days: mild, on left tonsil"; "five days: large patch over tonsils and uvula"; "two days: mild, thick, yellow"; "two days: mild, on tonsils"; "two days: severe"; "two days: moderate, bleeds a little"; "five days: moderate, grayish and tough"; "severe," etc., showing that there was illness sufficient to cause question of diphtheria.

A paper recently read by Dr. J. Priestley, Medical Officer of

Health for Lambeth, before the Metropolitan Branch of the Society of Medical Officers of Health, describes a school outbreak, following on a long series of slight throat cases, in which definite symptoms and membrane were produced by bacilli which were verified as Hofmann's, and associated with which were five cases of Löffler diphtheria. In the discussion on this paper several Metropolitan medical officers strongly stated their opinion that Hofmann's bacillus produces a form of diphtheria.

Further, Dr. Fletcher, who has had under his care at the Bristol Isolation Hospital many cases yielding on repeated examination only Hofmann's bacillus and apparently in perfect health, found that they showed certain symptoms, such as irregularity and feebleness of heart action, and a tendency to faintness, especially at night—in fact, very mild manifestations of usual diphtheritic symptoms. Wesbrook, in America, records an outbreak of diphtheria due to Hofmann's bacillus, and under my own care was a case which never yielded any bacillus but Hofmann's, but which was typically diphtheria, and died in ten days of heart failure.

From the above, it appears that Hofmann's bacillus can cause disease which apparently may resemble diphtheria closely, even to fatality.

Another reason is the constant occurrence of Hofmann's bacillus in the later cultures from Löffler cases, and the appearance of Löffler forms in many cases show only Hofmann's bacillus at first. Knowing that it has been alleged that the late appearance of Hofmann's bacillus is due to its being overlooked at first, its absence from first specimens containing Löffler was for some time carefully ascertained; yet in many of these cases it appeared in the late stages. On the other hand I have record of more than a dozen instances where cases, showing only Hofmann's bacillus at first, later, while under treatment and restraint, showed Löffler forms morphologically. It is not uncommon, either, to find specimens in which, apparently, transition forms between the bacilli of Hofmann and that of Löffler are numerous. I am aware that Dr. Sims Woodhead states that the type of bacillus remains constant throughout a case, but that is not our experience in Bristol, where, indeed, change of type, judged according to Wesbrook's classification, is common.

Then, the frequent association of persons showing Hofmann's bacillus only with others showing Löffler's bacillus among contacts is, at least, very suggestive of a connection between the two forms. My experience of the diphtheria epidemic at Avonmouth (*vide Public Health* for June, 1903) shows that until contacts with Hofmann's were dealt with the disease was not stamped out.

Another reason is the fact that in my own and the Barton Regis district more than twenty-five children yielding Hofmann's bacillus only have been treated in the ordinary wards with cases of diphtheria of every degree of severity, but they have in no instance contracted diphtheria. This is strong presumptive evidence that in some way they had been rendered immune—probably by Hofmann's bacillus.

Further, several instances have occurred in my experience where the only apparent or practically possible source of infection has been another child with Hofmann's bacillus only, either in its nose or throat.

With regard to the other varieties of pseudo-bacilli which morphologically resemble Löffler's bacillus, but which are not virulent to the guinea-pig, are not acid-producers, and do not stain with Neisser's solution, it seems to me even more probable that these may resume the virulence they have previously lost. In support of such being really diphtheria is the fact that a large number of contacts yielding morphologically Löffler's bacilli, chiefly from the nose, but who are apparently in good health, and among which there must have been several that would not produce acid, yet have been admitted into diphtheria wards in Bristol and the neighbourhood, and in no single instance have contracted clinical diphtheria.

Viewed from the standpoint of those who meet constantly with "pseudo" cases among contacts, there is strong presumptive evidence that such cases do cause cases of true diphtheria; and I venture to submit that until such bacilli can be dealt with in the laboratory under the exact conditions which they meet with outside in nature, it is neither justifiable nor safe to dogmatically assert either that under no conditions can these bacilli be harmful or reconvertible, or that they may be safely disregarded.

It may be somewhat out of place here to refer to the importance of examining the nose as well as the throat of all cases and contacts,

but my experience tells me that unless this be systematically done the chances of overlooking infection are very great. The Americans are in advance of us in the attention they give to this point.

I have no time to refer in detail to cases where, apparently, Hofmann's bacilli or other "pseudos" have caused diphtheria, nor to the success which has attended the dealing with outbreaks on the assumption that such bacilli are infectious, nor as to the means by which large numbers of such "suspicious" contacts may be dealt with. On these points I would refer you to papers published by me in *Public Health* for December, 1901, and June, 1903.

Finally, I would submit that cases showing Hofmann's bacillus and other "pseudo" contact cases should be treated, by being placed under a reasonable amount of restraint, and certainly by exclusion from school attendance.

III.

PAPER

BY

F. J. TANNER, M.R.I.P.H.,

Bacteriologist to the County Borough of Bournemouth.

At the onset I would state that under the heading of the pseudo-diphtheria bacillus I do not include those organisms which, with the exception of being non-virulent, are identical with the Klebs-Löffler bacillus. For practical purposes, I maintain that, whether virulent or non-virulent, an organism having all the microscopical and cultural characters of the true diphtheria bacillus should be labelled "Klebs-Löffler."

The organisms which I shall allude to as *Bacillus pseudo-diphtheriæ* have some essentially different morphological and staining characters as compared with *B. Klebs-Löffler*. The latter are too well known to need any description, but I will briefly mention a few of the differential features which assist in establishing the identity of pseudo, in contrast with Klebs-Loffler bacilli:

1. As a rule, in young cultures, the pseudo-bacillus is shorter and plumper looking.

2. With Löffler's methylene blue the staining is regular and comparatively dense.

3. There is rarely any indication of polar or granule staining. When there is, it is markedly different from that shown by the Klebs-Löffler bacillus.

4 With Neisser's method the evidence is negative—*i.e.*, the pseudo-baclllus is stained uniformly and entirely by the counter-stain, while the primary (blue) or granule stain is invisible. I regard this (Neisser) method as a valuable differential aid.

5. The pseudo-diphtheria bacillus does not produce an acid reaction when grown in glucose bouillon.

Many minor details have also to be considered, but their description is too lengthy to be dealt with on the present occasion.

In common with many others engaged in practical bacteriological work, I have repeatedly been impressed by the frequency with which the Hofmann or pseudo-diphtheria bacillus is met with in cultivations from throat-swabs. Various authorities have shown that these "pseudo-bacilli" are often present in the throats of apparently healthy individuals without giving rise to any marked symptoms. But it is in relation to diphtheria and doubtful throat disorders that the pseudo-diphtheria bacillus is especially interesting, and it would undoubtedly be of considerable advantage to those associated with public health administration if our knowledge of these organisms were more complete. It is most desirable that we should ascertain whether there is or is not any direct relationship between the *B. Klebs-Löffler* and *B. pseudo-diphtheria.*

I presume that there are many who, like myself, are frequently questioned as to what procedure should be adopted with reference to pseudo throats. I refer to those throat conditions which give rise to symptoms and arouse suspicion in the direction of diphtheria, but which only yield pseudo-bacilli on cultivation.

Should these cases be considered infectious? Should the patients be sent to isolation hospitals? If so, are they to be admitted to wards occupied by diphtheria patients? Should antitoxin be given?

Questions similar to these are continually cropping up, and it is only reasonable to suppose that the information given varies in accordance with the views held by the particular individual appealed to.

Personally, I am strongly in favour of considering the Klebs-

Löffler and pseudo-bacillus as being in some way related, but readily admit that it is a very difficult matter to prove or disprove conclusively.

In my official and private capacity in the county borough of Bournemouth and the adjoining neighbourhood, I have had a fairly extensive experience in routine throat bacteriology for several years, and on many occasions the evidence resulting from numerous serial examinations has tended to support the theory that the Klebs-Löffler and pseudo-bacillus may be altered forms of the same organism.

In my experience, the most frequent occurrence of the pseudo-diphtheria bacillus is during convalescence from diphtheria. As the Klebs-Löffler bacillus diminishes in number, the pseudo-bacillus often makes its appearance, and not infrequently thrives for a prolonged period. In some cultivations from throats where there has been a mixture of *B. Klebs-Löffler* and *B. pseudo*, I have found it difficult, if not impossible, to differentiate some of the organisms. The majority may be easy to classify, but the minority occasionally exhibit morphological and staining characters which partially resemble both *B. Klebs-Löffler* and *B. pseudo*, yet conform to neither type accurately. It has often occurred to me whether these ill-defined or "mixed" organisms might represent intermediate or transitional forms.

In investigating the pathological significance of *B. pseudo-diphtheria*, I have several times noticed the occurrence of these organisms in what might be described as a pre-diphtheria stage of certain cases which subsequently developed into true diphtheria. I may here state that in my neighbourhood extraordinary precautions are taken to have all doubtful throats submitted to bacteriological examination at the earliest possible period. I merely mention this fact to show the means by which I have been enabled to obtain bacteriological evidence concerning the initial, as well as the later, stages of diphtheria. In making these examinations, I have noted that in some cases—which the medical men in attendance have described as presenting the clinieal symptoms of early diphtheria—only the pseudo-bacillus could be found at first (several examinations), while later on—*i.e.*, forty-eight hours or so—the Klebs-Lëffler bacillus has

been easily demonstrated in considerable numbers, the general course of the disease being that common to diphtheria.

These remarks apply exclusively to patients who were seen and had swabs taken at the very first onset of throat symptoms.

The following is an illustration of the type of case just referred to:

The Pseudo-Diphtheria Bacillus in the Earliest Stage of Diphtheria—Miss X., aged fifty-one, kept a house for boarders in connection with a girls' school. This lady was unwell, and consulted her doctor. She complained especially about her throat. A swab was sent to me for examination. Result: a strong and almost pure culture of *B. pseudo-diphtheria*. The next day another swab was taken and subsequently examined, and again the pseudo-bacillus only was found.

The patient did not improve, and a third swab was taken—*i.e.*, third day from onset. This time the typical Klebs-Löffler bacillus came up vigorously on cultivation; a few pseudos were also present. The patient was removed to the Isolation Hospital, where she remained several weeks. The disease ran a very mild course, but was followed by paralysis of the soft palate, which persisted for some time.

At the end of the third week *B. Klebs-Löffler* could not be found in cultivations from the throat, but *B. pseudo* and cocci were present in considerable numbers. It was not until the end of the sixth week that *B. pseudo-diphtheria* disappeared. Antitoxin was given when *B. Klebs-Löffler* was first demonstrated, and local treatment was carried out both during the acute and convalescent stages.

In this instance it appeared as though the pseudo-diphtheria bacillus was responsible for the first condition of the throat trouble, and the fact that the true Klebs-Löffler bacillus followed so soon afterwards is sufficient to suggest transitional possibilities which are worthy of further investigation.

I am indebted to Dr. Hyla Greves, of Bournemouth, for kindly allowing me to mention this case.

Another instance bearing upon the subject under discussion is concerning two brothers.

A. B., a boy aged twelve, was sent home from a boarding-school near London in consequence of an outbreak of diphtheria amongst

the boys. For the first night at home A. B. slept with his younger brother, G. B., a delicate boy, aged ten. On the day after A. B.'s arrival he complained of his throat, and a medical man was called in to see him. Although nothing definite could be seen or diagnosed, a swab was taken and sent to me, owing to the suspicious history and circumstances. The throat swab yielded a strong growth of *B. pseudo-diphtheria* on cultivation. Several swabs were taken afterwards, and each time cultures of *B. pseudo-diphtheria* alone resulted. The throat soon cleared up, and the boy was quite well in a few days.

But the younger boy, G. B., who had slept with his brother for one night, began to sicken. A swab was immediately taken and sent to me for examination. Result: a copious growth of *B. pseudo-diphtheria.* Another swab was taken, and this time the *B. Klebs-Löffler* was found in considerable numbers, together with a few "pseudos." Antitoxin was objected to, consequently the throat exudation, although not extensive, persisted longer than the average case when so treated. At the end of five weeks there were still a good many Klebs-Löffler bacilli in the throat. The subsequent examinations gave results as follows:

Sixth week: Few Klebs-Loffler bacilli; numerous pseudo-diphtheria bacilli, and some (apparently) intermediate forms.

Seventh week: No Klebs-Löffler; numerous pseudo.

Eighth week: No Klebs-Löffler; pseudos fairly plentiful.

Ninth week: No Klebs-Löffler; few pseudos.

Tenth week: No Klebs-Löffler; no pseudos found.

The above sequence of events seems to afford evidence in favour of the view that the *B. Klebs-Löffler* and the *B. pseudo-diphtheria* bear some relation to one another. Presumably the boy A. B. arrived home from a diphtheria locality with some sort of infectious germs in his throat. Very shortly afterwards he suffered from a pseudo-throat, which quickly subsided under treatment. The other boy, G. B., apparently caught the pseudo-throat from his brother, and quickly passed from the pseudo condition into real diphtheria. There is reason to suppose that this delicate boy, G. B., would offer less resistance to microbic invasion than his more robust brother.

But the question arises as to whether something more might not be surmised; *e.g.*, did the enfeebled state of the boy G. B. provide favourable conditions for the *B. pseudo-diphtheria* to undergo fundamental changes and acquire virulence—otherwise to assume the general characters of *B. Klebs-Löffler*?

There was no other case of diphtheria in or near the house where these two boys sickened; no one else in the house complained of throat discomfort, and no defects could be detected in the sanitary arrangements.

The third and last example which I desire to bring before your notice differs from the preceding ones in that the case in question exhibited a certain alternation between the Klebs-Löffler and pseudo-diphtheria bacillus, which I have only once before met with.

On May 1, 1902, K. R., a girl aged twelve, was sent to the Isolation Hospital with diphtheria. The diagnosis was corroborated bacteriologically. The patient made an uneventful recovery.

Bacteriological throat examinations were made during convalescence at weekly intervals, with results as follows:

	Klebs-Löffler Bacillus.	Pseudo-diphtheria Bacillus.
Third week	numerous ...	none.
Fourth "	few ...	plentiful.
Fifth "	none ...	plentiful.
Sixth "	none ...	plentiful.

At this stage the patient was apparently perfectly well, and the parents insisted on taking the child home, against the wish of the medical superintendent.

Three days later the child was brought to the hospital again with what was described as a second attack of diphtheria. A throat swab was taken immediately after admission, from which I isolated numerous Klebs-Löffler bacilli; no pseudo-diphtheria bacilli could be found.

On making inquiries as to the sanitary condition of the patient's house, I was informed by the inspector that no defective drains were discovered, but the general condition of the house was dirty and stuffy. The nurse who went with the ambulance to fetch

the patient on the second occasion spoke of the vitiated atmosphere, closed windows, and exclusion of light by curtains, etc.

The child did well after her return to hospital. In a couple of days nothing could be seen on the tonsils, but a delicate gray, filmy conaition remained on the back of the throat.

The following bacteriological examinations were subsequently made:

Days after Second Admission.	Klebs-Löffler Bacillus.	Pseudo-diphtheria Bacillus.
Seven	few ...	numerous.
Fifteen	none ...	fairly plentiful.
Twenty-one	none ...	few.
Twenty-eight	none ...	none.
Twenty-nine	none ...	none.

The parents were advised as to the necessity and means of making their house more sanitary. The child was discharged from hospital, and remained well.

This case may, of course, be regarded simply as one of re-infection, but it is curious that there were other people (children and adults) in the house all the time, and they showed no signs of diphtheria, and the child was supposed to have caught the disease originally at school. The facts I desire to recapitulate are:

1. The patient on admission to hospital had numerous Klebs-Löffler bacilli in her throat,

2. During convalescence these organisms gradually diminished in number, and pseudo-diphtheria bacilli appeared.

3. After a period of six weeks the patient was free from Klebs-Löffler bacilli, and apparently well, but she had numbers of pseudo-diphtheria bacilli in her throat.

4. She left the hospital and returned to her home, *where the hygienic conditions were very undesirable.*

5. This within three days was followed by a second illness, when no pseudo, but numerous Klebs-Löffler bacilli were found.

6. After the patient's readmission to hospital the Klebs-Löffler bacilli quickly diminished in number, and the pseudo-diphtheria bacilli reappeared.

Might not this be an illustration of transition or transformation

of an organism due to changed environment? I admit that proof is wanting, but the same drawback exists as regards many biological problems. I have often had reason to suspect that the pseudo-diphtheria bacillus may be an attenuated form of the Klebs-Löffler bacillus, which, under certain conditions, may not only have its virulence restored, but whose morphological and other characters may also undergo profound modifications.

I am aware that eminent writers have expressed their opinions to the effect that *B. pseudo-diphtheria* (1) bears no causal relation to diphtheria, (2) is not responsible for the spread of the disease, (3) but is an organism entirely separate and distinct from *B. Klebs-Löffler*. I venture to think that those views are at variance with the opinions held by a large number of practical bacteriologists who are associated with public health administration.

In the present state of our knowledge the pathological significance of the *B. pseudo-diphtheria* may be described as an unknown quantity. Under these circumstances I think it is acting in the best interests of the community to adopt some such system as that carried out by the Medical Officer of Health and profession generally in the County Borough of Bournemouth. Briefly, it is this: If a patient suffers from throat symptoms which are sufficiently suspicious to call for a bacteriological examination, and *B. pseudo* alone is found, the case is regarded as infectious *pro tem.*, while a second swab is taken, and, if necessary, a third. If such cases are sent to the infectious hospital they are placed in isolated observation wards; they are only admitted to the general diphtheria wards if subsequent cultivations reveal the presence of the Klebs-Löffler bacillus. As regards the administration of antitoxin, this remedy is not often given in my district for purely "pseudo" conditions. When it is the dose is usually a prophylactic one. On the other hand, in true diphtheria antitoxin is universally used.

These fragmentary notes, abbreviated case histories, etc., contribute little, if anything, not already known with reference to the pseudo-diphtheria bacillus. I was induced to accept the invitation to write upon the subject, hoping thereby to elicit the views and experiences of other practical workers rather than to enlarge upon my own.

In conclusion, I desire to express my indebtedness to Dr. P. W. G. Nunn, Medical Officer of Health for Bournemouth, for permission to publish bacteriological details of his cases, and for many advantages concerning investigations and hospital work.

Discussion.

Mr. Edward C. Bousfield, D.P.H. Camb. and Lond. (Bacteriologist to the Borough of Camberwell), said: Whilst I do not feel that I could usefully contribute a formal paper to your proceedings, yet personally I have no doubt that, for practical purposes of diagnosis, any attempt to place reliance on morphological differences between the bacillus of Klebs-Löffler and that known by the name of Hofmann (though it also was discovered by Löffler) is fraught with danger. Of the various tests which have been proposed for distinguishing rapidly between the two, that of Neisser only has the least claim to be regarded as reliable, and that, in my experience, in only the most limited sense.

I have frequently received for examination swabs yielding pure cultures of a bacillus which was absolutely negative to Neisser's reaction, and which yet occurred in cases presenting the clinical features of diphtheria and yielding rapidly to antitoxin. One such case to my mind furnishes far stronger negative evidence than can be deduced from any number of cases in which a similar bacillus occurs in apparently healthy throats.

It is my invariable practice to return as diphtheritic all cases in which a "diphtheroid" bacillus is found, and no proof—sufficiently cogent to induce me to alter this practice—has yet been offered that the Hofmann bacillus is not merely a variety, *not necessarily devoid of virulence*, of the Klebs-Löffler organism. Much wider divergences than any which have hitherto been demonstrated in this connection are known to exist in other cases in which no specific difference has been even suggested.*

Professor M. A. Stanley Kent, (Director of the Bacteriological Laboratory, University College, Bristol), said: In view of the great importance of the relationship existing between the presence in

* *E.g.*, various *races* of *Bacillus coli* and *B. ent.* (Gaertner), in morphology, number of flagella, and production of acid and indol.

throat and nasal discharges of the "pseudo-diphtheritic" or "Hofmann" bacillus on the one hand, and the occurrence of symptoms of diphtheria on the other, it is perhaps worth while to place on record the two following cases.

CASE 1.—O. C., a boy of about nine years; admitted to hospital suffering from typical diphtheria. Disease ran a mild course, was followed by marked paralysis of palate, and was benefited by antitoxin.

Repeated careful examination of throat and nose showed Hofmann in pure culture. Klebs-Löffler was never found.

CASE 2.—A child admitted to hospital suffering from typical diphtheria; the disease ran a severe course, ending in death.

Repeated careful examination of throat and nose showed Hofmann only, Klebs-Löffler never being found.

The cultures from these two cases have been preserved, and are being tested as to their cultural characteristics. So far as these tests have at present gone there seems no reason to doubt that they are really the Hofmann organism.

I may say further that as the result of an examination of more than 3,000 cases in the last few months there is little doubt in my mind that the Hofmann bacillus is capable of producing symptoms of diphtheria in patients in whom it occurs, and also of acting as a *materies morbi* for the spread of the disease.

Dr. BUCHANAN (Health Department, Glasgow) acknowledged that the subject was a very difficult one. He was surprised to hear that Dr. Cobbett distinguished absolutely between the two forms, the true diphtheria bacillus and the Hofmann bacillus. He believed that there were a series of transitional forms connecting the two, and his experience coincided with that of other speakers that there might be a considerable change in the morphology of the organism present during the course of the illness, the universal tendency being towards the pseudo type as convalescence approached. He considered that the question was one for collective investigation. He did not think it was necessary or practicable to exclude children from school attendance who showed the presence of the pseudo-bacillus unless there were throat symptoms, when they should certainly be excluded.

Dr. LORD (London) advocated the free and early use of diphtheria antitoxin in any case presenting suspicious throat symptoms.

Dr. BOND (Medical Officer of Health for Holborn) also advocated the early use of antitoxin in large doses. It should always be administered if there were any exudation, not waiting for the results of the bacteriological examination.

Professor HEWLETT (King's College, London) said that he was one of those who provisionally believed that the Hofmann bacillus was a modified non-virulent Klebs-Löffler bacillus. He was quite prepared to change this view on good evidence forthcoming, but the present discussion, especially the clinical details brought forward by some of the speakers, had rather strengthened his opinion. The Hofmann bacillus resembled the Klebs-Löffler bacillus not only in most of its cultural characters, but in its curious mode of division, and in producing skatol-carboxylic acid. His view of the relationship of the two organisms was that the Hofmann bacillus was a very non-virulent Klebs-Löffler bacillus—that is, was far removed from virulence. He did not see that there was any logical objection to the idea that just as there were gradations in virulence, some organisms being slightly, others markedly virulent, so there might be gradations in non-virulence, some organisms being slightly non-virulent and readily convertible into virulent forms, others very non-virulent or far removed from virulence. The non-virulent, morphologically diphtheritic forms (the pseudo-bacilli of the French) he would class as being not far removed from virulence, the Hofmann bacillus as being far removed from virulence. This would account for the difficulty experienced in converting the Hofmann bacillus into a virulent species.

THE HEALTH OF MALTA AND GOZO IN 1902.

THE population of the islands of Malta and Gozo is 193,315; the birth-rate is 39 per mille, and the death-rate 25 per mille. The infantile mortality is high, while the mortality among children under five years of age is more than 50 per cent. of the total mortality. The work of inspection is vigorously carried out, as may be seen by the fact that in the year 1902, 239,545 dwellings and 31,832 shops were inspected. The islands were visited by small-pox, 10 cases, diphtheria, 147 cases, cholera, and influenza. The veterinary section of the report concludes with the remark: "Cattle-breeding in Malta is a non-paying concern, even on the most approved lines." The report shows clearly that, considering the means available, the work of sanitary inspection is efficiently performed.

BACTERIOLOGICAL NOTES.

I.

THE STAINING OF BACTERIAL FLAGELLA WITH SILVER.*

BY

J. W. W. STEPHENS, M.D. CANTAB.,

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IN a short communication to the *Lancet*, 1898, I stated that by using largin, an albuminate of silver, I had easily been able to obtain well-stained and clear specimens of flagella. I observed at the time that this body, largin, smelled distinctly of ammonia, and I suggested that my success in using this modification of Van Ermengem's well-known method was due to this cause. I was unable at the time to pursue the matter further, and left it to any other person interested in the subject to carry out. So far as I know no one has pursued the subject in this direction, and it is only quite recently that I have again taken the matter up.

I will not here give all the many experiments I made; suffice it to say that it soon became clear that the advantage in using largin depended, not upon its albuminate, but upon its ammonia content.

So that I next experimented with ammoniacal silver solutions, but found that it was more convenient to add the ammonia to the tannic and gallic acid solution of Van Ermengem, because ammonia precipitates this acid solution, and by dissolving the precipitate in excess of ammonia a clear solution is got. With this ammoniacal solution I was able to get beautifully stained specimens.

I next proceeded to find out which constituent of Van Ermengem's somewhat complex mixture was the essential one, and I found that an ammoniacal solution of tannic acid alone gave as good results as Van Ermengem's mixture. So far as I have experimented,

* A paper read before the Liverpool Congress of The Royal Institute of Public Health, 1903.

gallic acid alone has not given me positive results. It was next a question of determining the best proportions of tannic acid and ammonia respectively, and after numerous trials I find that good results can be constantly got in the following way, though I do not assert that I have yet found the best proportions:

I take no extraordinary precaution in cleaning glass slides—for the whole of the staining is most readily done on slides—except that after cleaning with a pocket-handkerchief I heat the slides thoroughly on a clean piece of wire gauze over the Bunsen.

The emulsion is made in the ordinary way, or, for simply determining whether or no a bacterium has flagella, I smear a mass of culture, moistened with water, over the slide in the same way as I would make a blood smear with a needle. So far I have used Van Ermengem's mordant osmic acid and tannin. I have, however, got positive results by using tannin alone after mordanting for some days, but have not made many experiments in this direction. I use then the following solutions:

1. Van Ermengem's mordant of osmic acid and tannin, one half to one hour.

2. A 0·1 per cent. solution of silver nitrate.

3. Five per cent. tannic acid + 5 per cent. NH_3 solution (*partes æquales*).

Wash off the mordant thoroughly with tap-water.

Pour some of the silver solution with a pipette over the slide, then add a few drops of the ammonium tannate solution till a deep reddish-brown colour is produced, and allow to stain for a minute or so, or as long as no black precipitate is formed.

Wash off in ordinary tap-water.

Repeat this procedure two or three times until the film has a deep brown or somewhat black colour.

It is usual in describing a new method for staining flagella to claim that the preparations are most beautiful and quite free from precipitate. Without asserting this, I will simply say that in my hands this method has given, with great ease, good preparations.

II.

ABSTRACTS FROM FOREIGN PUBLICATIONS.

Poisoning by Aniline Dyes (*Revue d'Hygiène*, April, 1903).—The Council of Hygiene and Salubrity of the Seine discussed the report of Mr. Riche upon dyes employed to blacken yellow leather boots, and expressed the opinion that there is reason to prohibit the sale of dyes containing aniline or toluidine in a pure state.

Contribution a l'etude de la Diarrhée des Jeunes Veaux. Lesage and Delmar. (*Ann. d. l'Inst.* Part xv., 417, 1901.)—The authors have made a bacteriological study of a disease more or less common among young cattle, which is somewhat similar to what is known as "white scour." This disease has previously been studied by a number of bacteriologists, who reached the conclusion that it is produced by certain varieties of the common *B. coli*. These authors differ totally from this conclusion. They find, it is true, that the *B. coli* is almost always present in the cases of this disease, but the universal presence of this organism is no special argument, inasmuch as it is so widely distributed. They find, however, another form of bacterium present—a coccus, which they say belonged to a group called Pasteurella. This organism, from the very outset, they regarded as suspicious, and they instituted a series of careful experiments, which convinced them that this, and not the *B. coli*, is the cause of the disease in question. This organism is capable of producing the disease in experiment animals, when properly inoculated, and is always found characteristic of the disease. The disease is somewhat rapid, proceeding to its crisis sometimes in one to two days and sometimes in eight to fifteen days. It is especially characteristic of young cows, and is believed by the authors to find entrance into the animal by means of the umbilical cord, and thence into the blood. In animals slightly older the inoculation is chiefly through the nasal membranes. It produces a septicæmia of the blood, which progresses until usually it is eventually fatal. The authors have attempted to find some method of vaccination against this disease, but, although their results are promising, they are not, as yet, especially successful.

CHEMICAL NOTES.

FORMATION OF SULPHURETTED HYDROGEN ON BOILING MILK. (*Utz. Milch-Zeit.*, 1903, xxxii., 354; *Chem. Zeit.*, 1903, xxvii. [67], Rep. 204.)—The author has previously detected, by means of lead paper, the presence of sulphuretted hydrogen on boiling milk, and has now confirmed the presence of this compound by a test with the reagent (ammonium molybdate and potassium thiocyanate) recommended by Ganassini (see *Journ. Soc. Chem. Ind.*, 1902, 1246).

PREPARATION OF CONDENSED MILK RICH IN FAT. A. SAUER, Germany. (*Fr. Pat.* 328,600, January 19, 1903.)—One thousand litres of milk are evaporated under reduced pressure at a temperature below 50° C. until the volume is reduced to 200 litres. Forty-five kilos of butter, previously boiled with water and filtered, are then added. The mixture is then further concentrated at the same temperature and filled into suitable closed receptacles in which it is sterilized by placing in boiling water for eighteen minutes.

PREPARATION OF WATER FREE FROM AMMONIA FOR WATER ANALYSIS. J. B. WEEMS, C. E. GRAY, and E. C. MYERS. (*Proc. Iowa Acad. Sciences*, x., 112-113.)—Sodium peroxide is added to distilled water in the proportion of 1 dram to each litre of water. The water is then boiled for thirty minutes or longer, when it will be free from ammonia. The time of boiling and the amount of sodium peroxide to be added depend on the quantity of ammonia which may be present in the water. Water may also be prepared free from ammonia and nitrogen as nitrates and nitrites, by treating it as above and distilling from a copper retort, the first portion of the distillate being rejected.

DETERMINATION OF CARBONIC ACID IN DRINKING WATER. F. B. FORBES and G. H. PRATT. (*Journ. Amer. Chem. Soc.*, 1903, xxv. [7], 742-756.)—In Pettenkofer's method considerable errors may be introduced by slight errors in the titration with $\frac{N}{10}$ acid of so small a quantity of water; the authors have, therefore, in their experiments treated about 400 c.c. of the water with the reagents and titrated several portions of 100 c.c. of the clear liquid with $\frac{N}{50}$ sulphuric acid, the usual precautions being observed.

For the separation of free from half-bound carbonic acid the water was allowed to fall drop by drop into a tube about 2·5 feet long and ⅝ inch in diameter, which was filled with gravel, and through which a current of air was aspirated. This removed the free acid, and the half-bound carbonic acid was then determined as before.

In Seyler's method (*Analyst,* xxii., 312) the free carbonic acid was first titrated, with phenolphthalein as indicator, and the half-bound carbonic acid calculated from the fixed acid, which was determined by Hehner's method, methyl orange being used as indicator.

The Seyler method tends to give higher figures than Pettenkofer's method, but these are nearer to the true values, as shown by the results of the boiling method and by experiments on standard solutions.. In seven out of twenty cases, however, in which complete results by the three methods did not differ by more than 0·2 of a part, removing the free carbonic acid by aspiration in the modified Pettenkofer's method is shown to be sufficiently accurate. In Seyler's method of titration, with phenolphthalein as indicator, the end-point is sometimes difficult to determine, but magnesium salts do not cause disturbance as in Pettenkofer's method. The determination of the half-bound acid by calculation from the amount of fixed carbonic acid by Hehner's method is satisfactory, and the results, though showing a tendency to be too low, are higher than those obtained by Pettenkofer's method.

Preference is given to Seyler's method on account of its rapidity.

THE MUCKERJI AND HABERMANN-OESTERREICH TESTS FOR PHOSPHORUS. J. SCHINDELMEISER. (*Rezept,* 1903, ii., 18; through *Chem. Zeit. Rep.*, 1903, 158.)—From experiments upon putrescent materials and blood, to which phosphorus either alone or as a solution in oil had been added, the author concludes that the Muckerji test is less sensitive and less suitable for practice than that of Mitscherlich. The Habermann-Oesterreich test is a modification of the latter, and consists in introducing water into the condenser during the process. It is better, however, to use steam, leading it into the reaction-flask and through the condenser. In this manner the test always proves successful, even if the organic matter contains alcohol or phenol.

PUBLIC HEALTH MEDICAL APPOINTMENTS.

JOHN WALTER BROWN, B.A., M.D., Medical Officer of Health for the County of Hokianga, New Zealand.

JOHN FREDERICK HODGSON, M.D. Vict., Assistant Medical Officer of Health, Halifax.

JOHN HOUSELY, M.D. St. Andrews, Medical Officer of Health of the Retford Urban District Council.

BOOKS, JOURNALS, REPORTS, ETC., RECEIVED.

The following books, journals, reports, etc., have been received:

The Lancet; The British Medical Journal; The Sanitary Record; The Surveyor; The Medical Times and Hospital Gazette; The Medical Review; The Pharmaceutical Journal; The Councillor and Guardian; Albany Medical Annals; The Glasgow Medical Journal; Public Health; The Journal of the Society of Chemical Industry; Egésyég; La Presse Médicale; La Salute Pubblica; The Journal of Tropical Medicine; The Caledonian Medical Journal; The Public Health Engineer; The Journal of the United Service Institution; The Journal of the Association of Military Surgeons of the United States.

Local Government Board Report on the Sanitary Circumstances of Thame Rural District; The Proceedings of the XIth International Congress of Hygiene; The 35th Annual Report of the Sanitary Commissioner for Bengal; Revision of the Statistics presented by the Committee on Tuberculosis; Report of the Chief Medical Officer, Malta and Gozo; Annual Report, St. Helens; An Experimental Investigation of *Trypanosoma Lewisi*; Intestinal Parasites; Report of Working-party No. 1, Yellow Fever Institute; British Journal of Inebriety.

Letters, Notes, Queries, etc.

Communications respecting Editorial matters should be addressed to "THE EDITOR, JOURNAL OF STATE MEDICINE, 19, Bloomsbury Square, W.C." *Those concerning business matters, non-delivery of the* JOURNAL, *etc., should be addressed to* "THE SECRETARY, The Royal Institute of Public Health, 19, Bloomsbury Square, W.C."

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Telephone number of The Royal Institute of Public Health, No. 1614 Central.

The Journal of State Medicine.

THE OFFICIAL ORGAN OF
THE ROYAL INSTITUTE OF PUBLIC HEALTH.

VOL. XI.] NOVEMBER, 1903. [No. 11.

THE HARBEN LECTURES FOR 1903.

Delivered in King's College, University of London.

BY

FERDINAND HUEPPE, M.D.,
Professor of Hygiene in the German University of Prague.

LECTURE I.

GENERAL VIEWS ON THE ÆTIOLOGY OF INFECTIOUS DISEASES.

MR. PRESIDENT AND GENTLEMEN,—The scientific researches in hygiene in our times are especially characterized by the studies of the causes of infectious diseases. The practical measures which have been taken to promote public health are also determined by the conceptions of ætiology. It is singular that, in spite of this, no real agreement has been reached on what should be called the causes of disease.

Experience has shown that in some of these diseases, which attack large numbers of the population, the peculiarity of the constitution of the person affected is of the utmost importance—as, for example, in tuberculosis or leprosy. In other diseases which affect the masses of the people one remarks external causes as especially important, as in cholera or plague.

These external causes being so apparent, one attempted to try to recognise them, and one succeeded in finding them in the shape of pathogenic microbes or bacteria. One happily found such pathogenic bacteria as external causes also in such diseases

which were formerly known as constitutional—for example, in tuberculosis and leprosy. With this knowledge there was no longer any real difference between the two groups of diseases.

The idea that an "animated contagium" is the external cause of a specific infective disease is very old. In the middle of the last century it was brought forward in the form of a hypothesis by Henle and Bassi, and finally proved by Klebs, Dujardin, especially by Pasteur and Koch.

This branch of the pathology, the so-called bacteriology, was in great opposition to the cellular pathology as it was taught by Goodsir and Virchow. According to these last physicians, the "diseased cell" is the entity of the disease (*ens morbi*), and this point of view was in the last few years most distinctly directed by Virchow against my conception.

If the diseased cells are the entities of infectious disease, the opponents of Virchow must have been quite wrong. But this is impossible, because one could infect animals in an absolutely certain manner by injection of pure cultures of pathogenic bacteria.

On this account the bacteriologists made the opposite mistake to that made by Virchow, and regarded the pathogenic bacteria as entities. The cells of the body and their products were for the bacteriologists nothing else than nutritive media for the bacteria. According to this opinion, the peculiarities of the specific bacteria were taken to be the real cause of the specificity of the specific disease. If we knew the morphology and biology of the bacteria we should know all that was necessary about the disease, and practically it should enable us to prevent them invading the body, and also to destroy them.

Besides these two different views there still exists a third opinion. The representatives of this third opinion—Simon, Farr, and Parkes in England, Pettenkofer in Germany—recognised that external conditions were of great importance in the propagation of infectious disease. These conditions have been called "predisposition of place and time." By getting rid of the external conditions we prevent the disease by means of sanitary works. Through these facts this branch of hygiene has proved

that specific infectious diseases are avoidable. This has been established in the most striking manner in the case of typhoid fever.

The three different views of the ætiology of infectious diseases —that the real cause lies (1) in the entity of the diseased cells; or (2) in the specificity of the pathogenic bacteria; or (3) in the decisive external conditions—could not be brought into agreement with one another, and thus the continuity of medical science was interrupted.

The pathologists did not understand and appreciate the facts and conceptions of the bacteriologists, and the bacteriologists had not enough understanding of the researches of the pathologists. Therefore one heard the signal, "Physician against bacteriology," by Rosenbach, and Cornet answered: "It is a fatal supposition to recognise any other cause than bacteria."

In science every fact must be accepted by every researcher, but no fact can lead us to ontological ideas such as those which I have already mentioned. Such entities are in natural science like the relics or petrifactions of an early period. Medicine, as a natural science, must be free from such ideas.

For this reason I tried to demonstrate in 1888-93 that for an infectious disease to break out, the cells of the body, the pathogenic microbes, and the external conditions must be in energetical or dynamical relations with one another.

During the last ten years this conception has been adopted more and more by physicians and hygienists, so that it is a pleasure for me to accept the invitation of your President to express here my conceptions on the causes of infective diseases.

If an infectious disease breaks out in a natural manner, we observe that all people exposed to the infection do not become ill, and that of those who become ill some suffer in quite a different manner from others. Years ago the physicians deduced from this the conception of the "predisposition" to disease (*dispositio ad morbum*). On the other hand, the bacteriologists, such as Koch, Cornet, and Jäger, came to the conclusion that there is no predisposition, but that the infection depends only on the presence and quantity of pathogenic bacteria; this was called

the "exposition." Baumgarten believed that there is only a predisposition of the species or race, and that every individual animal of such a species or race can be infected. I have collected together such a number of examples of the predisposition of species and individual animals that now nearly all physicians accept the conception of the predisposition, and some bacteriologists—for instance, Paltauf and Wassermann—say that the predisposition is an old and comprehensible conception, as if no bacteriologist had denied it. That can only be rehabilitation of the old conception of predisposition; but predisposition alone can be defined as an entity, as it has been so defined by the pathologists till this day. For my conception the rehabilitation of the predisposition does not suffice; but I will, however, remark that I was the first, as a bacteriologist, who claimed this rehabilitation, in 1889-93, because a pathologist—Hansemann—in 1903, ten years after this rehabilitation, says that in all bacteriological studies predisposition had been quite ignored.

Predisposition is a fact, and must, therefore, be accepted by all naturalists.

According to the pathologists and the bacteriologists, predisposition was only a negative idea, in "opposition" to the positive idea of immunity and immunization. Immunity was always recognised as a positive process, because one observed that after being attacked by a specific disease one acquired a resistance against this disease.

In opposition to these ideas, I was the first to deduce, in 1889-93, from the facts that predisposition to disease must be something positive, that nothing can become apparent as specific disease that has not been preformed in the specific faculties of the protoplasm. In this conception predisposition is something positive, and a "correlate" to the immunity. Predisposition of the protoplasm corresponds to the constitution of the molecules in chemistry.

Protoplasm, or active proteid, as molecule, is such a complicated thing that we are not yet able to recognise its constitution exactly by the analytic and synthetical methods of chemistry. For this reason we recognise the constitution by the biological method

through impulses which correspond to the atomic groups of the protoplasm. Such an impulse is called the "stimulus" (*irritans, irritamentum, incitamentum, catalysator*).

Only such stimulus can produce an effect if it has corresponding groups, as is known in the case of the enzymes: that is the real meaning of the specificity of the pathogenic bacteria as stimuli. Physiological assimilatory stimulus agrees with the specific cell protoplasm as a good key fits a lock, whereas pathogenic bacteria agree with the same specific protoplasm as a false or skeleton key fits a lock, which lock becomes either destroyed or opened.

Infection and immunization is, according to my conception, the biological method of recognising the predisposition, which cannot be demonstrated directly.

Specific immunization in a natural way or experimentally is only possible if the protoplasm of the body has specific characteristic qualities, which qualities we can so far only recognise through the stimulus of corresponding impulses.

Immunity and immunization directly prove biologically that predisposition must be a positive property of the protoplasm, for otherwise there can be no immunization. Immunization is the augmentation of faculties which are preformed as predisposition. Every animal cannot be infected by, or immunized against, every pathogenic microbe. The assertion of Robert Mayer, when discovering the law of the conservation of energy, "*Ex nihilo nihil fit*," has also its value in biology and pathology, as I have said before.

It has been long recognised that the predisposition of man can be influenced and changed. The statistics and experiences of physicians show us that in the normal evolution of man the predisposition of the child is different to that of the adult. Every man has besides his inherited nature also a "second nature," which is not only dependent on the normal evolution, but also on all the influences of his environment and on internal influences as well. For example, cold, heat, damp, hunger, and thirst, mechanical injuries, intoxication (as alcoholism), constitutional illnesses (as diabetes or rickets) can augment the predisposition to infectious disease.

In other cases slight illnesses, which we now take to be infectious, as catarrh or rheumatism, augment the predisposition. The infection is, then, a form of "nosoparasitism," or of "mixed infection."

A man who has had an infectious disease is either protected from receiving it a second time (immunity) or not (contra-immunity), according to the disease.

Through these illnesses the specific cell protoplasm can be weakened in a general manner, or in a more specific manner, in so far as these illnesses probably cling to the tissues, which can now be attacked by other specific pathogenic bacteria. In other cases, through such processes, the epithelium, which protects the body from being invaded by the pathogenic microbes, becomes injured, and cannot any longer prevent the bacteria from entering the body.

In other cases, again, the tissues are so changed by such processes that pathogenic bacteria cannot now enter the body from the parts where they generally invade or infect. If a pigeon is vaccinated in the breast muscle against fowl cholera at a certain stage, it will be immune when inoculated on that side where the injection had been previously made, although still susceptible to the disease when inoculated into the other breast.

In some cases we can recognise, by microscopical and chemical methods, that the protoplasm has altered, whereas in other cases these methods do not suffice, and we must recognise by the biological method, especially by immunization, that alterations of the protoplasm have occurred.

I will here make a few remarks on some interesting anatomical predispositions. Cohnheim supposed that cancer could originate from displaced embryonal cells. Weismann and Wiedersheim suppose that rudimentary organs can be the real origin of disease. Such organs have nothing to do with the propagation of the species. They are quite removed from adaptation and selection, and for this reason their vitality is decreased.

Freund assumes that ossification in the region of the first rib can favour tuberculosis of the lungs, and Wiedersheim proves that the upper part of the thorax of the human being is exposed phylogenetically to a regressive process which is not yet fixed. I

believe that in some cases there is an anthropological cause to be found for the formation of predisposition. If two different races of mankind intermix, different types of propagation cells meet together and form discordant or inharmonious organs. For example, the eyeball does not agree with the orbit, or the teeth do not agree with the jawbone, and this can be the origin of disease.

It is statistically known that cancer is to be found more in the North than in the South of Italy. Kruse believes that this is because in the South of Italy the population consists for the most part of pure Ligurians, whereas in the North the population is very mixed, consisting of dolichocephalic Germans and Ligurians and of brachycephalic Turanians.

The idea that pathogenic microbes must be the true and sufficient cause and specific entity of disease originated from the dogma that the pathogenic bacteria have an unvarying specific character. This opinion is disproved by many facts: (1) Pathogenic bacteria, in a virulent state, can be present in healthy men without giving rise to any disease. Bacteria of diphtheria, pneumonia, tuberculosis, and cholera have often been found in the bodies of healthy men. (2) The disease-producing bacteria should exert no other effect than that of producing disease. With pure cultures of pathogenic bacteria we recognise that pathogenic bacteria are not restricted to parasitic existence. Thus, for example, the cholera bacteria form a yellow pigment upon potatoes, and in sugar solutions cause an acid fermentation. To this class of phenomena I have given the name of "cycle of activity," and demonstrated that the conception of pathogenic and saprophytic bacteria has only a relative value. (3) The ability of the specific pathogenic bacteria to produce disease is not constant, and varies in its capacity, as was first demonstrated by Buchner and Pasteur. (4) The same specific bacteria do not affect all animals alike with the same typical disease. Leprosy, cholera, and relapsing fever are only known to occur in man, whereas tuberculosis, plague, glanders, and anthrax attack men and also certain species of animals. (5) Pathogenic bacteria should produce only a single sharply-defined typical and specific infective disease,

but diphtheria bacteria may occasion local diphtheria or acute blood-poisoning or paralysis. Pneumonia germs cause typical pneumonia, blood-poisoning, inflammation, suppuration; tubercle bacilli excite tubercle formation and infiltration of the connective tissue, inflammation, suppuration, and true consumption. (6) Similar symptoms and anatomical changes can be evoked through the action of entirely different germs. For example, the formation of nodules or tubercles in connective tissue can be brought about by the germs of tuberculosis, leprosy, and glanders. Tubercle, typhoid, pneumonia bacteria, gonococci, staphylococci, and streptococci may cause endocarditis. (7) If we inoculate animals of various susceptible species in the same manner and with the same specific bacteria of the same virulence, according to the weight of the animal, we get for every typical infectious disease a scale of susceptibility.

In all these cases we recognise no entity of the pathogenic microbes, and also no entity of the diseased tissues and cells.

Now we understand the mistakes of the cellular pathologists, because their attention was only paid to the form of the machine, as it is technically called, or to the "determinants," as it is termed in the case of organisms. The mistake of the bacteriologists was due to the fact that they carried out their experiments with artificial injections and not with the natural infections.

Herein there is a great difference. One example may suffice to demonstrate this difference. Guinea-pigs are so easily infected with tubercle bacilli that they are the best test object for tuberculosis by inoculating them; but of all the guinea-pigs in laboratories, perhaps not one has become spontaneously ill from tuberculosis.

Besides the predisposition of the body and the pathogenic bacteria, we will now consider in the shortest manner the influence of the external conditions. It has long been recognised that external media, as water, air, and food, can help to convey the pathogenic bacteria from infected to healthy men. If we do away with such external conditions we prevent the infection. In this sense we say that infection can be avoided; but the external conditions have a much greater importance. Sydenham observed

that the same infectious disease can vary in different epidemics, and called that "genius epidemicus."

These variations of the same epidemic disease in different places or at different times originate from the fact that the environments act as a stimulus on men and animals, as is known since the researches of Darwin.

I have mentioned before the value of these external stimuli in their relation to the predisposition and second nature of man. It was demonstrated by Buchner and Pasteur that the peculiarity of the pathogenic bacteria—namely, that of producing specific disease—can be influenced by these external stimuli, so that they are no longer able to bring about any illness, but behave like harmless saprophytes.

In the course of these investigations on the attenuation of specific pathogenic bacteria I recognised that phylogenetically the origin of all infectious diseases must lie in the processes of putrefaction, and I distinguished several degrees of the adaptation to parasitism: facultative parasites, facultative saprophytes, and obligatory parasites.

The group of facultative parasites comprises those species which can maintain and reproduce themselves in a purely saprophytic way upon lifeless material without even necessarily attacking living hosts as parasites; indeed, to attain certain stages of development it is sometimes necessary that they should live the life of real saprophytes.

The facultative saprophytes are those germs that we find as a rule living as parasites, but which under special conditions can maintain themselves also upon lifeless material, and by breaking down this lifeless nutrient substance are able to grow, multiply, and perpetuate the species.

In the group of obligatory parasites the dependence on the processes of putrefaction and the ability to live at the cost of and by the destruction of lifeless food material have gradually been completely lost, or at least such relations have up to the present not been made out.

With these conceptions of Buchner, Pasteur, and myself, one understands better that pathogenic bacteria are not so constant

as they were taken to be by Koch, but that they vary according to the external conditions. The constancy of the infectious disease which permits us to distinguish one disease from another and to bring them to a systematic order is relative, and depends on the relative constancy of the external conditions. The external conditions are accordingly no entities.

From all these facts we must recognise that illness is an energetical process, and can be defined as a function of changeable predisposition, changeable stimulus, and changeable external condition.

Each one of these factors can vary from minus to plus, from nought to infinity. If we mark illness "I," predisposition "P," stimulus "S," and condition "C," we have, as general expression,

$$\mathrm{I} = f\ (\mathrm{PSC}):$$

This is not an hypothesis—"Hypotheses non fingo," as Newton said—but it is the real expression for the facts.

If the conditions are constant or are without special value, so that they can be neglected or posed as nought, we have then

$$\mathrm{I} = f\ (\mathrm{PS}).$$

Every one of these factors can be composed of several single factors, so, for instance, the predisposition "P" can be inherited (p) and acquired (p'); then we have in place of P ($p + p'$), and the formula becomes

$$\mathrm{I} = f\ (p + p',\ \mathrm{SC}),$$

and so on.

In every case we can examine each factor separately with suitable methods, and we can compare any one factor with any other. For instance, Ammon examined the relations between the predisposition and the quantity of the pathogenic germs, and was able to make this clear by constructing exact curves according to Gauss.

Recognising disease as a function and being able to express the different factors mathematically as curves, pathology acquires the same degree of exactitude as has been possessed by physiology for some time.

The different methods of hygiene, as statistics, clinical observa-

tions, post-mortem examinations, chemical researches, physical and biological experiments, must all work together in order to recognise the different single factors.

With our recognition of energetical relations between predisposition, pathogenic microbes as stimuli, and external conditions to the disease, our practical aims are both increased and made clearer.

We must continue to fight against the external conditions of infective disease in a similar manner to that in which it was begun in the last century by the English sanitary engineers here in the mother-country of modern hygiene. We must fight against bacteria, and this fight has become simpler ever since we have paid more attention to the peculiarities of each special disease germ. On this point I quite agree in principle with Koch.

But all this does not suffice for the future. You know much better than I, by the researches of Haycraft, Sidney and Beatrice Webb, and Sir Thomas Cranford, that here in England, as on the Continent, as a result of the great modern industrial development, there is an impending danger for the quality of our race. We must fight against this danger through decreasing our predisposition to, and by increasing our resisting power against, disease.

In consequence of my energetical point of view, the preventive methods of hygiene for this purpose must be made complete with the methods of positive hygiene.

Practice alone would keep us into a groove from which there was no outlet, but practice combined with scientific researches guarantees our progress in public health.

PRESIDENTIAL ADDRESS

TO

THE SECTION ON ENGINEERING,

AT THE LIVERPOOL CONGRESS, 1903.

BY

GEORGE F. DEACON, M.Inst.C.E., M.Inst.M.E.

Twenty-seven years ago it was my privilege to listen to the notable address delivered in this city by the late Mr. Thomas Hawksley as President of the Health Section of the Social Science Congress.* On that occasion Mr. Hawksley pointed out that it had "been the habit of sanitary philosophers to regard the condition of the health of Liverpool as being exceptionally and pre-eminently bad." Mr. Hawksley proceeded, with complete success, to show that this impression was an entire fallacy, and that, if a comparison were made with the state of the other large cities most nearly approaching her in magnitude—namely, Manchester and Glasgow—the sanitary status of the three cities would be found to be practically identical.

Nine years ago, from the chair of the Engineering Section at the Liverpool Congress of the Sanitary Institute, I had an opportunity of comparing the death-rate from certain zymotic diseases in Liverpool with the corresponding death-rates in the other seventeen large cities and towns of England which were at that time separately enumerated in the mortality returns of the Registrar-General. I was then enabled to show that, during the decade (1870-80) in which Mr. Hawksley spoke, some marked change had occurred which placed Liverpool in a very much better position relatively to the past than the average of the whole of the other towns, and that this relative improvement had been continued up to the year 1894, when the Congress of the Sanitary Institute met in Liverpool.

Again, after a period of twenty-seven years from the date of Mr. Hawksley's address, The Royal Institute of Public Health

* Address on "Health" by the late Thomas Hawksley, past President of the Institution of Civil Engineers (*Transactions of the National Association for the Promotion of Social Science*, 1876).

has, in appointing me to this chair, afforded me a further opportunity of referring to the subject and of stating that this very satisfactory condition of things has not only been maintained, but actually improved. Thus the figures I gave in 1894 showed that, whereas during the years 1870-75 the zymotic death-rate of Liverpool was 5·4, the average of the six succeeding years was only 3·7, being a reduction of 31 per cent., while the corresponding reduction of the same diseases in the seventeen large towns and cities enumerated at that time in the Registrar-General's returns was only 20 per cent. In the following twelve years—that is to say, from 1882 to 1893 inclusive—the corresponding average for Liverpool was 3·1, showing a reduction on the first period of 42 per cent., while that of the other towns showed a reduction of 35 per cent.*

The remaining period that has since elapsed, from 1894 to 1902 inclusive, gives an average for Liverpool of 2·9, showing a reduction on the first period of 46 per cent. as compared with 36 per cent. in the case of the other towns.

The zymotic death-rate of Liverpool may now be favourably compared with any city of approximately corresponding population in this country, and there is no manner of doubt that the decade 1870-80 witnessed a change that can only be accounted for by the sanitary improvements effected during that period, and set out in the address to which I have alluded.

It is not necessary to repeat at the present time the statement I then made, but it may be worth while to record in the JOURNAL OF STATE MEDICINE the great advance which Liverpool made during that decade in the matter of water-supply.

In 1871 the engineering responsibility fell upon me. Liverpool was at that time supplied from two sources—namely, several great wells in the New Red Sandstone formation in the neighbourhood of Liverpool, and the Rivington reservoirs lying in the hill district of Mid-Lancashire, between twenty-five and thirty miles from the Town Hall. The Rivington Works consist substantially of six reservoirs, having a united area of 615 acres, and a storage

* The diseases included were: enteric fever, typhus, simple and ill-defined fevers, diphtheria, diarrhœa, dysentery, scarlet fever, and measles.

capacity of 4,500 million gallons. The water they contain is received by gravitation from an area, principally moorland, of about 10,000 acres, and is brought by gravitation to Liverpool.

These works and the Longdendale Works of Manchester were then the largest undertakings in the country for the supply of water by gravitation from reservoirs constructed in upland valleys and supplied by mountain moorlands. But Rivington, even with the help of the wells, had proved insufficient. In the year 1865 it had been necessary, for the sake of economy in water, to revert to the old system of intermittent supply, and in 1871 I found this pernicious system still in force. It was perfectly clear that the existing works did not yield sufficient water to afford a constant supply, and that as a natural consequence most serious sanitary evils followed; not mainly, of course, because the people were deprived of an unlimited supply of water, but owing to the inevitable pollution of the water they received by the drawing of foul air and water into the defective distributing mains and service pipes owing to continued leakage at low points during the intermissions of supply, when the pressure in the pipes often fell below that of the atmosphere. The actual work of suppressing leakage under the "waste-water meter" system was begun in the summer of 1873, and, district by district, constant service was restored, until eighteen months later the whole of Liverpool was again receiving a practically unlimited supply. But the suppression of leakage still continued, and in 1894 I pointed out that it had not only enabled the Corporation to change the system of supply from intermittent to constant, by reason of the water now saved and formerly wasted, but had actually had the effect of so far reducing the demand in relation to the supply as to produce an available surplus of water capable of affording constant supply to the rapidly-increasing population, until the inauguration of an additional source of supply; and I added that the value of the water so saved, after covering the whole of the expense of saving it, paid for all time the interest upon £750,000, being that part of the capital cost of the new works which had then been expended. In his address of 1876, already referred to, the late Mr. Hawksley tersely summed up the position in the following

words: "The supply has been changed with great advantage from a restricted intermittent to an unrestricted constant system, and as a consequence of the admirable method . . . devised and adopted for the discovery, suppression, and prevention of waste, the municipality has emerged, as respects the quantity of water at its disposal, from a state of actual poverty—poverty in the midst of plenty—to a condition of redundant wealth."

During the decade 1860-70 my predecessor in Liverpool, the late Mr. Thomas Duncan, M.Inst.C.E., had reported the necessity for additional supplies, and he and others had projected certain schemes for the purpose. At the end of 1895 the suppression of leakage had removed all cause for immediate anxiety. But when everything had been done that could be done in this way it was clear that the increasing population would, in something like ten years' time, consume the whole of the additional water thus rendered available. As the result of this consideration, and at the instance of the Corporation, a most thorough investigation as to available sources of supply in the future was therefore made. This investigation extended over the rivers of Lancashire, the lakes of Westmorland, and the rivers of North Wales. Windermere, treated partly as a gravitation and partly as a pumping scheme, was the first favourite; but further investigation pointed out the beautiful lake Haweswater in Cumberland as the most suitable source. The level of Haweswater could be readily raised by means of a dam placed at its lower or northern end upon the existing rock foundations. The height of the present lake above the sea is no less than 723 feet, which was sufficient for all the purposes of Liverpool and the surrounding district, and the water was of the highest quality. As long ago as March, 1877, I reported to the Corporation the advantages of that scheme; but the ink of that report was scarcely dry when, as the result of the still continuing investigation, I appended a postscript referring to a subsequent examination of the upper waters of the river Vyrnwy, a tributary of the river Severn, in Montgomeryshire. At the same time, I submitted a further report and stated that, notwithstanding my strong views with reference to the suitability of Haweswater, I had since found

that the Vyrnwy possessed all the more important advantages of Haweswater with some advantages which Haweswater did not possess. This change produced a great controversy in the proceedings of the Corporation and in the public newspapers, but the Vyrnwy ultimately triumphed.

This great undertaking received the sanction of Parliament in 1880, and was inaugurated in 1892. The water derived therefrom is of the greatest possible purity so far as organic matter of animal origin is concerned. The source of supply—the river Vyrnwy in Montgomeryshire—wound, when I first saw it, through an upland valley draining an area of some 18,000 acres, containing the dwellings of about forty families, a churchyard, two chapels, and the village inn. With the exception of a few isolated sheep-farms, the whole of these were removed.

In the course of investigations in relation to the expediency of forming a great reservoir on the alluvial plain which formed the bottom of this valley, it was discovered that the rock at the narrow entrance to the valley was considerably nearer to the surface than at points higher up the valley. It was therefore clear that what was then an alluvial strath, about five miles in length, had, before the deposition of the silt, been a rock basin containing water; and subsequent investigation showed that the valley was the site of a post-glacial lake. Those who have had the advantage of visiting the Lake Vyrnwy Hotel have observed how remarkably natural and fitted to its surroundings the modern lake appears to be.

The principal feature is the great masonry dam, the first masonry dam of importance constructed in this country. It had its foundations on the Silurian rock which, when exposed 80 feet below the river, was found to be striated and dislocated exactly as it had been left by the last glacier in its recession up the valley when giving place to the ancient lake.

The general particulars of this undertaking are recorded as follows:

Area of the modern Lake Vyrnwy: 1,121 acres.
Length of the modern Lake Vyrnwy: 4¾ miles.
Width of the modern Lake Vyrnwy: ¼ to ⅝ of a mile.

Height of overflow above mean sea-level: 825 feet.

Volume of water in the lake actually available for the purposes of Liverpool.: 12,131,000,000 gallons.

Greatest depth from the water-level to the bottom of the valley: 84 feet.

Drainage area contributing directly to the lake: 18,000 acres.

Drainage area capable of being diverted to the lake: 5,200 acres.

Length of masonry dam from rock to rock: 1,172 feet.

Height from rock foundation to parapet of carriage-way: 161 feet.

Volume of masonry: 260,000 cubic yards.

Statutory compensation water: average about 13,500,000 gallons per day.

Available supply to Liverpool when the three lines of pipes, of which the greater part of the aqueduct consists, have been completed: more than 40,000,000 gallons per day.

Distance measured along line of aqueduct from Lake Vyrnwy to the Liverpool Town Hall: 77 miles.

Length of Vyrnwy Aqueduct from the lake to the service reservoirs at Prescot, Lancashire: 68¼ miles.

Number of balancing reservoirs on the aqueduct: 5.

On the line of aqueduct, in addition to several rivers, five canals, eleven railways, and one navigation were crossed; but the most serious undertaking was the tunnel through water-bearing silt and sand under the Mersey.

The water is filtered at Oswestry.

Lake Vyrnwy is still much the largest artificial reservoir in Europe.

Commensurate with this great undertaking are the supplies to Manchester from Thirlmere—inaugurated in 1894—and to Birmingham from the Elan, in Radnorshire, a tributary of the Wye in Radnorshire, now approaching completion. The water-level of the natural lake Thirlmere can be raised by the masonry dam at its outfall about 50 feet, thus providing a storage of about 8,130,000,000 gallons. Upon the Elan, three reservoirs having an aggregate capacity of 11,130,000,000 gallons have been formed, and the

Corporation of Birmingham is authorized to increase this storage to 18,000,000,000 gallons by means of three further reservoirs on the Claerwen, a tributary of the Elan.

Thus one of the greatest of our cities has for many years received pure water from the mountains of Wales. A second will do so in a short time; and it is to be observed that this water is being provided without any depletion of the streams from which it is taken. The system of compensation water now almost universally adopted not only avoids depletion, but actually increases, sometimes three or four fold, the natural dry-weather flow of the stream. This will be readily understood when it is recognised that in mountain districts of this country a high flood represents a discharge per unit of time varying in quantity from 200 to 1,200 times the minimum natural flow of the stream. The larger discharges of such a stream are not only useless, but frequently harmful to the river, and their conservation for the supply of pure water to distant communities, and incidentally for the augmentation of the dry-weather flow of the stream from which the water is taken, is a benefit alike to the distant communities and the riparian interests below.

This being so, it is to the advantage alike of the principality, and of the great centres of population in this country, to know that among the mountain valleys of Wales there are post-glacial lake basins, now for the most part silted up, upon the sites of which reservoirs may be formed, each having a capacity three to four times as great as that of Lake Vyrnwy. Many of these great upland valleys have a sufficient altitude to supply water by gravitation even to the most easterly extremities of England, and are fed from areas and by rainfalls so proportioned to their capacities as to form ideal schemes of water-supply.* It is necessary on national grounds that the Metropolis and seat of Government should never be entirely dependent upon distant sources; but an abundant supply of pure water, or of water which can in practice be rendered quite safe, cannot be obtained in the neighbourhood of London, and I am convinced that the day is not far distant

* "Encyclopædia Britannica," tenth edition, vol. xxxiii., pp. 788, 789.

when supplemental supplies, at least, will be drawn from the great natural basins of the West.

Thus, to revert to Liverpool, the completion in 1892 of the Lake Vyrnwy Aqueduct, supplementing the supply of water from Rivington and the wells, came just in time to prevent, with slight exceptions, any return to that pernicious system of intermittent supply which, at the end of 1875, had been rendered unnecessary by the suppression of leakage. The zymotic death-rate of Liverpool, though still somewhat above the average of the seventeen great towns with which the Registrar-General dealt in 1870 was, as I have said, greatly reduced in the 1870-80 decade by the sanitary measures set out in the address of 1894 already referred to, including the prevention of the inter-communication of water-borne disease, as effected by intermissions of supply and consequent fall of pressure in the mains below that of the atmosphere.

Much has been done, and no doubt something still remains to be done; but further diminution of the mortality of Liverpool must be sought chiefly in the improved habits of the people and in the continued reduction of overcrowding.

THE ROYAL INSTITUTE HEALTH LECTURES.

January to March, 1904.

THE following lecturers have been appointed to deliver the Health Lectures in York, Worcester, St. Helens, Blackpool and Lincoln:

Professor E. W. HOPE, M.D., D.Sc.
Professor THOMAS OLIVER, M.A., M.D., F.R.C.P.
Professor C. S. SHERRINGTON, M.A., M.D., F.R.S.
Professor WILLIAM R. SMITH, M.D., D.Sc., F.R.S. Edin.
Professor G. SIMS WOODHEAD, M.A., M.D., F.R.S. Edin.
JAMES CANTLIE, Esq., M.A., M.B., F.R.C.S.
ANDREW WILSON, Esq., Ph.D., F.R.S. Edin.

SOME ADDITIONAL POWERS REQUIRED FOR THE EFFECTUAL CONTROL OF SMALL-POX.

BY

S. G. MOORE, M.B., D.P.H.,

Medical Officer of Health for Huddersfield.

It is not proposed to deal in this paper with the question of the general vaccination and revaccination of the population. It cannot be doubted that the recent epidemic in the Metropolis and the present outbreak in the North of England will compel attention to that aspect of the subject.

It is my object to consider certain deficiencies which have appeared to me while actually dealing with an outbreak of the disease, to invite discussion, and to put forward certain suggestions. Incidentally the question arises how the recent and existing prevalences became possible, in view of the facts that small-pox is a preventable disease, and, in addition to the measures which are available against other infectious diseases, we have, with respect to this particular malady, a preventative in vaccination, which the experience of those who have practical knowledge of the subject shows to be an effectual means of limiting its spread.

The simplest manner of setting forth systematically the deficiencies in the precautions available will be to start from a consideration of the precautions themselves. These comprise—

(*a*) Prompt and rigorous isolation of the patient.

(*b*) Careful, complete disinfection of the premises, fomites, and infected persons with their clothing.

(*c*) Immediate vaccination or revaccination of all who have been exposed to the danger.

(*d*) Isolation of all contacts, so far as practicable, until two clear days after the maturation of vaccine vesicles, especially and imperatively in cases where the exposure has taken place at such a date that vaccination cannot be expected to overtake the infection.

(*e*) Daily observation of remote contacts.

(*f*) Daily observation of other contacts, whose vaccination has been performed at such a time that it may be expected to afford protection, lest the vaccination should not have taken.

By these means, with alertness and care, it may with reason be anticipated that any second crop of cases will be discovered so soon and under such circumstances that, by a prompt repetition of the process, the third crop will be avoided. To consider these seriatim with respect to their deficiencies :

(*a*) As isolation is understood to-day, it is safe to assume that with rare exceptions this measure is efficiently carried out; and even in instances where the first case does not come under the notice of the Sanitary Authority until after numbers of persons have been exposed to infection for so long that they cannot be protected by vaccination, if the remaining precautions can be duly carried out the third crop of cases will be prevented, and a speedy termination put to the outbreak.

(*b*) Disinfection also is now well understood, and, with the exercise of reasonable care and thoroughness, no failure is likely to take place under this head.

(*c*) In the next means of control, namely, prompt vaccination, we come to the first stumbling-block. Difficulties arise in two ways, namely, the difficulty in discovering all contacts, and the division of authority between Boards of Guardians and Public Health Authorities. With reference to the former (and it may conveniently be stated here that similar considerations apply to all the precautions applicable to contacts), it is startling and almost incredible that, among the uninformed classes of the community, there is a widespread desire to conceal, on the one hand, that they have been visited by friends, or, on the other, that they have visited cases of the disease. This was strikingly exemplified in Huddersfield early in the present year, where a man who was discovered on the third day of his illness deliberately (as he subsequently admitted) concealed the fact that he had spent some time that day in the company of a friend, who consequently escaped having vaccination offered to him, who did not himself adopt this means of protection, and fourteen days later developed an attack of small-pox which proved fatal. There is thus afforded an instance of a misguided person, as the result of a wilful mis-statement, condemning his friend to death, and, in the present state of the general law, not thereby rendering himself liable to any punishment. This constitutes a serious defect in our armour against

small-pox. Many instances of the same sort of thing have come under my notice lately. In several other persons, as the result of similar concealment, the disease has occurred, though happily wtih less tragic results.

Adverting now to the other difficulty in securing the prompt vaccination of contacts, it should be clearly understood that no reflection is intended to be made on the Guardians of the Poor nor on their officers. It is exclusively against the unwieldiness of the machinery necessary to be put in motion that experience has shown animadversion may properly, and, in fact, ought to be, directed. Starting from the point that the Public Vaccinator is the only medical man to whom it is practicable to look for vaccination of the great majority of small-pox contacts, the steps to be taken involve a communication from the Sanitary Authority to the Clerk to the Guardians, from him to the Vaccination Officer, and from the latter to the Public Vaccinator.

Departure from this method, though highly desirable, and, it may be, in particular instances necessary, is calculated sooner or later to give rise to misunderstanding, and perhaps friction. A direct communication from Medical Officers of Health to Public Vaccinators is open to be regarded as a supersession of other officers. On the other hand, by adopting the formal method of communication delay inevitably arises. Moreover, the need for vaccination occurs at all hours, and, in the case of common lodging-houses, unless the offer of vaccination be made coincidentally with the announcement of the presence of small-pox, another opportunity may not occur. It has on several occasions of late been found necessary to vaccinate the inmates of lodging-houses in Huddersfield after the public-houses had closed at night, and before the inmates set out for their daily work at half-past five in the morning.

(*d*) With reference to the isolation of contacts, one of the difficulties has already been referred to, namely, that of discovering everyone who has been in contact with the disease; but there is another and more serious one. No power exists for compulsory isolation, and, in the sense of removal to a shelter of persons having fixed places of abode, this is unnecessary, undesirable, and impracticable. But there are classes with respect to which authority is face

to face with two alternatives: either to permit the dissemination of small-pox or to restrict the liberty of the subject. These classes cannot easily be defined in a word or a phrase: they may not all be called tramps or vagrants. Some of them call themselves pedlars, and others hawkers. On the other hand, the definition of being without fixed place of abode is too wide-sweeping, and would include in some cases commercial travellers, and other classes not in any way requiring to be dealt with as are tramps and other similar individuals. This is one of the difficult points for consideration, where discussion will probably be of much value. It is desirable on other as well as sanitary grounds, that tramps and vagrants should be brought under some sort of control. Not only are they largely responsible for the spread of infectious disease and the dissemination of vermin, but also for the persistence of immorality and the perpetration of crime.

It has come under notice, in attempting to trace the movements of several suspected to have carried small-pox from place to place lately, that a distinct proportion are fugitives from justice. These latter considerations are put forward with the view to indicate that by their compulsory isolation no hardship would be inflicted, nor any reasonable right of liberty infringed.

As a matter of fact, such individuals are frequently isolated after exposure to small-pox, under existing conditions, but there are no direct legal powers for such proceeding. The result is that occasionally excessively large payments have to be made to them in satisfaction. An instance occurred in Huddersfield in January of the present year, when a wandering labourer, who had lived in a common lodging-house where a case of small-pox was discovered on the fifth day of the disease, was maintained in isolation for a period of eighteen days; he objected to revaccination, at the end of the time he refused to submit to disinfection, and threatened, unless he were paid the sum of 4s. per day, including Sundays, that as soon as he did get out he would consult a solicitor, with a view to making a claim for damages. As his wife had received a sum of money during the period of his isolation, this claim was considered unreasonable, but in view of the absence of statutory authority for his isolation it was deemed expedient to concede to his demand. It is

pertinent to take into account what sort of an individual the man was. The relation of a single incident will illustrate his character. The weather was very inclement at the time; his wife, who had not been living with him, had a sick infant, and complained of the hardships which she was undergoing. On this being represented to the man, as an inducement to him to become more reasonable, he made an insinuation that the woman was not his wife, which she disproved by producing the certificate of her marriage. Among a number of other statements he made, the following further illustrate the same point:

"I am comfortable and warm where I am; let my wife make a living for herself and the child. I've kicked her eye out once, and I can do it again."

It will be recognised, by all who have had experience, that this type is, unfortunately, not exceptional among his class; and this being so, it does not seem reasonable to urge that the liberty of the subject must be held inviolate. A discretion might properly be claimed as to the isolation of persons where dangerous epidemic diseases of the graver kind are concerned, and if necessary a magistrates' order might be made a requisite preliminary, to be granted on the certificate of the Medical Officer of Health; but it is undesirable that opportunity for the occurrence of delay should be permitted in cases where promptitude is the essence of success.

Another difficulty connected with the vagrant classes in the presence of small-pox comes about in the following way: Where a tramp is found suffering from small-pox, it is manifestly of great importance to discover where he contracted the disease. It may be that the source of infection has remained unknown to the Public Health Department of the locality concerned. It has repeatedly happened in the present year in Huddersfield that the statements of such individuals have been found not capable of verification, that they have not been known at the places where they stated they had been at the critical period, and in three instances the writer was able, not only to show that they had not been where they stated, but also to trace them in other places. In this relation it is a very great deal easier to indicate the present unsatisfactory condition of affairs than to suggest a remedy, although could one be found it would be

of great value. The only way which seems feasible is the adoption of a system of passports, one of which every person who could not satisfy the authorities that he had, and was known at, a fixed place of abode might be required to produce on demand. It would, however, be necessary that such passport should contain a very careful description of the individual to whom it had been granted, with some simple anthropometric particulars, and if practicable a photo. The most apparent objection to such a plan seems to be its costliness; a lesser one is that there would be some difficulty in its application, but the advantages to society in general, as well as to the public health service in particular, would be so great that the expenditure necessary would be justified. At present the regulations requiring the registration of the names of the inmates of common lodging-houses are quite useless; any name is deemed good enough to be given, and, in the lower class of lodging-house, to be accepted. On one occasion recently, where the names of forty-four lodgers were taken twice on the same day—once at the lodging-house and once at a disinfecting-station—these forty-four persons furnished sixty-six different names, and among them was a man who, when asked by me what name he had given, admitted that he had forgotten which particular name he had used on the former occasion.

With reference to (*e*)—the daily observation of the remote contacts—and (*f*)—that of other contacts whose vaccination may have been performed late—no further comment appears necessary.

It appears, from what has been set forth, that in order to render the precautions available against the spread of small-pox complete three provisions need to be made, namely:

1. Power to vaccinate or revaccinate all persons who have been exposed to the infection of the disease.

2. Power to isolate contacts under certain definite circumstances.

3. That it should be made an offence to make false statements or to withhold information in connection with this malady.

The view appears to be accepted in many quarters that compulsory vaccination has passed away for good, and it is believed that by leaving some discretion in the hands of the public opposition to the measure will be minimized. This hope is far from being justified by

recent experience. The ladies and gentlemen who have made opposition to the subject their own particular *métier* appear to be as active as ever, and in one town in the North of England notorious for the heterodox views of a section of its inhabitants, even in the presence of an outbreak of the disease, the numbers of certificates granted to "conscientious objectors," day by day and week by week, continue to be considerable. It seems desirable, not in the interest of any profession or of any section of the community, that those who believe that in vaccination exists a sure preventative of smallpox should be equally conscientious as those who do not, and in particular it would appear to be at the same time the most logical, the most consistent, and the most expedient attitude of those who are best fitted by their practical experience to form an opinion on the question to maintain their position and to proclaim their beliefs, to refuse to accept as satisfactory a compromise which imperils the health of populations and the lives of human beings. However that may be, it does seem necessary, for the successful limitation of an outbreak of small-pox, that power should be given to insist upon vaccination or revaccination of every person irrespective of his private opinions, who have been exposed to the infection. Should it appear necessary to respect his "opinion"—under that name or under the name "conscience"—power to compel isolation without compensation should be given. In other cases, where it appears necessary to isolate, provision should be made for the payment to those isolated of an amount representing their earnings during the period previous to isolation, equal to that during which they were under observation, subject to a deduction representing the value of the accommodation provided for them. Such payments would form an inconsiderable charge, having regard to the income of the class of individuals for whom such provision would be requisite.

It cannot be expected that by these or any other means an outbreak of small-pox will become limitable suddenly and with certainty, in like manner as, for example, the movements of an engine can be stopped. Human effort is too fallible and modern society too complex to permit of that hope, but, on the other hand, it does appear that such powers would materially increase the usefulness of the existing weapons, and go far to achieve success.

LATENT SCARLET FEVER AND ITS IMPORTANCE EPIDEMIOLOGICALLY.*

BY

DR. P. CAZIOT,

Physician to the Heriot Military Orphan Asylum.

(*Translated by Staff-Surgeon O. W. Andrews, R.N.*)

(Continued from page 598.)

ONE of the most convincing proofs in my opinion of the genuineness of latent scarlatina is that it is not a special form of scarlatina, solitary and completely irregular, but that it is allied by very close bonds to two little-known varieties of this disease—viz., the scarlatinette of Roger and non-febrile scarlatina. So, as I have already said, the characteristic feature of the epidemic which I have observed was the excessive mildness of the cases in the majority of instances; I have gone over three cases of scarlatinette, three of non-febrile, three of latent scarlatina, and two of *scarlatine fruste* (ill-defined variety), out of a total number of eighteen cases. We shall, then, now be able to study scarlatinette and non-febrile scarlatina, and compare them with latent scarlatina; then to show that these forms can insensibly merge the one into the other, and that between them there is only a difference in degree.

As its name indicates, scarlatinette is a diminutive form of scarlatina. It is a scarlet fever in which all the symptoms, and especially the general symptoms, are attenuated. I have seen three cases of it, and this is how this variety, the first transition between normal scarlatina and latent scarlatina, generally shows itself: The rash is more or less discrete; the peeling very slight or next to none; the initial sore throat is often only a slight dysphagia, with a slight swelling of the tonsils, without redness at the back of the throat, or without any very discrete rash in the mouth; the fever scarcely exceeds 101·3° or 102·2° F., and returns quickly to normal. But that which seems especially to characterize scarlatinette is the extraordinary attenuation of the general phenomena. Debility and drowsiness scarcely exist, the appetite is not lost, and

* From *La Semaine Médicale* of June 24, 1903.

one is surprised at seeing the body covered with a rash in a person whose countenance retains all the appearances of good health, and which has occasionally not prevented the appearance later on of some grave complications of scarlatina. One of my patients had a trace of albumin in the urine on the second day. This attenuation of the general phenomena unfortunately leads to masking the disease to some extent, and when it occurs in a patient suffering from a slight sore throat, with only a moderate amount of fever and good general health, one does not suspect scarlatina, especially if it happens in a child. One knows that children react in a very marked manner to infections, and that the debility, the prostration, and drowsiness are often out of all proportion to the cause which has given rise to them. If, then, in a child with enlarged tonsils one notices a slight amount of fever, with an otherwise almost normal state of health, unless one verifies the body rash (because one must put little trust in small signs), and especially if it occurs at a time when there is not an epidemic, one will think of everything but scarlatina, the invasion of which is in the majority of cases much more evident.

Here, then, is the first variety of atypical scarlatina, in which is found a very notable diminution in the intensity of the general phenomena (drowsiness, headache, lumbago, sickness, etc.), as well as the frequent disappearance of the mouth eruption and special conditions of the tongue, classical symptoms of scarlatina; it preserves only an indistinct sore throat without redness, a fine rash, a very medium amount of peeling, and some fever.

But it may happen that the last-mentioned symptom is absent, and then one meets with a paradoxical form of scarlatina—scarlatina without fever. One knows that people will exclaim, "Scarlet *fever!*" For them and for the majority of medical men scarlatina is a fever accompanied by a rash. Notwithstanding the works of Rilliet and Barthez, who have been the first to observe them, and the studies of M. Fiessinger (d'Oyonnax),* of M. Couatarmanach,† of M. de

* Ch. Fiessinger, "La Scarlatine Apyrétique" (*Gazette Méd. de Paris*, 4 et 11 mars, 1893).

† A. Coudtarmanach, "Étude sur une forme anomale de la Scarlatine (Scarlatine Apyrétique)" (*Thèse of Paris*, 1893).

Moizard,* the apyretic form is but little known. It deserves to be discussed, and I shall do so at some little length, because its study will enable me to show that the element of fever is not an essential accompaniment of scarlatina, and consequently that it is legitimate to admit cases of scarlatina called latent, in which neither severe sore throat, nor fever, nor general phenomena, nor "such or such" other symptoms are found.

Non-febrile scarlatina, of which I have seen three cases, generally shows all the symptoms of normal scarlatina, except the fever. With one of the patients the commencement was quite insidious, and except for a little drowsiness the subject of it seemed to be just as usual. He would certainly have been overlooked if I had not been in the habit of always examining the bare chests. As regards the other two cases, one was rapid and the other but moderately so. The initial sore throat may be very great; it was even sometimes pseudo-membranous. Most frequently it is only moderately marked, and in three cases it was in one insignificant and in two moderately intense.

The buccal rash was occasionally very marked; sometimes, on the other hand, it was invisible. The desquamation of the tongue, according to M. Fiessinger, never occurs; I have known it, however, in two out of three cases. Varying with the cases, the rash is more or less marked, and, with the exception of the feet and hands, the desquamation shows itself by the fall of small furfuraceous scales. In regard to that which they call the minor signs (*petits signes*) they seem to me to be entirely wanting.

If the local phenomena and the eruption appear to be on the whole of the same kind as in ordinary scarlatina, it is not so with the general phenomena, which are, on the contrary, mostly very attenuated. I have pointed out that the commencement may be very insidious. The pulse, according to M. Moizard, would generally seem to be accelerated, and he makes this increased rate a point in diagnosis. Our patients at the commencement had a pulse-rate of 80 and 100, and the eldest of them showed 110 beats per minute. The rapidity of the pulse, then, has nothing definite about it. The

* Moizard, art. "Scarlatina," in *Traité des Maladies de l'Enfance*, de Grancher. Comby et Marfan, t. 1, p. 131. Paris, 1896.

sensation of fatigue, the drowsiness, the debility, are less marked than in ordinary cases, and if one of the little patients did happen to suffer from weakness and from lumbago, pretty severe for two or three days, the other two, except at the moment of invasion, kept a satisfactory general state of health and a good appetite.* Finally, and above all, the fever was either completely absent or else quite insignificant or transitory.

In one case, in fact, two hours after the sudden commencement, the temperature rose to 102·2° F., but the very next day it fell again to 100° F., and, singularly enough, from the third to the eighteenth day the patient had a certain amount of *hypothermia.* His temperature oscillated between 96·8° and 98·6° F. Another had a temperature of 101·4° F. on the second day, but this was the only rise above 100·4° F. and did not occur again, even from the fifth to the twelfth day; except once, when it reached 98·96° F., the temperature remained, like the first case, below 98·6° F. With the third patient the rise of temperature did not exceed 99·8° F. It is curious to see this slight subnormal temperature in two cases, and very clear in others elsewhere, of a disease in which a high temperature is generally the rule, but such observations ought not to surprise us any more, since one has observed a certain number of fevers *without temperatures*—pneumonia, enteric, influenza, and even malarial fever—where these "hot stages" (*accès chauds*) have been replaced by true "cold ones" (*accès froids*). The reason ought to be very clearly attributable to a special, abnormal mode of action of the scarlatina toxin on the thermic centres; these centres can be excited, spared, or paralyzed, as the case may be, according to the greater or lesser degree of virulence of the toxin, and also, without doubt, according to the greater or lesser resistance of the subject. The virulence of scarlatina poison is not a constant quantity, and according as it is exalted or lowered we see this or that particular symptom of scarlatina displayed by preference.

What are the two characteristics of ordinary scarlatina? Fever and a rash under all its forms (cutaneous, serous, mucous), and with all its sequelæ (desquamation, ulcerations). It is, then, clear that

* It is not, perhaps, useless to observe that our patients took no medicine, and *a fortiori* no antipyretic.

scarlatina possesses two essential properties: that of acting energetically on the heat-regulating centres, and that of acting more or less powerfully on the vasomotor centres. But if these two properties are, in the great majority of cases, intimately associated, and ranking equally in importance, it would seem that it is not always so, and in certain very severe cases, as well as in certain very mild ones, the one effaces the other: in other words, when the scarlatina poison is excessively virulent, the vasomotor property would be less exalted than the fever-producing one, and, inversely, when the toxin is of lowered virulence the fever-causing property disappears almost completely, whereas the vasomotor property is preserved almost intact.

Clearly this observation is not unalterable, and I am not unaware that there are hæmorrhagic forms of malignant scarlatina, and also mild cases of scarlatina, in which the rash, if not entirely absent, is at any rate very fleeting. But let us consider the extreme cases where the toxin is abnormally lowered or abnormally intensified in virulence. In the fulminating cases of *scarlatina maligna*, and in the *nervous forms* of scarlatina, which scarcely yield to them in gravity, the fever, the hyperpyrexia, is at the first onset excessive. The temperature runs up to 106·7° F. and upwards, the whole organism is at once struck by a veritable heat stroke, and death supervenes more or less rapidly, but it is nearly always impossible to observe the slightest rash. It appears, then, that in the very severe types, by some kind of inhibitory phenomenon, the property of producing hyperpyrexia has rendered the body incapable of reacting to the vasomotor property; or, rather, what comes to the same thing, that the exacerbation of the former has led to the enfeeblement of the latter; or, in other words, that the two properties are not capable of being exalted side by side.

On the other hand, in the *attenuated forms* in the cases of scarlatinette of which I have spoken the rash and vasomotor phenomena are perfectly clear and the fever is less important. In the non-febrile forms, and especially in the varieties called latent, one sees even more clearly still this effacement of one of the two specific properties of the virus of scarlatina. In the three non-febrile cases there was perfectly distinct peeling of the body and of the palms

and soles, but the fever was wanting, and the general symptoms were very attenuated. The three latent cases of scarlatina had (at least, as far as I was able to ascertain) in one case a short eruption, with perhaps a little tracheal or pharyngeal irritation and a vague sort of headache, in another an attack of common and quite insignificant sore throat, with temperature 101° F. and redness at the back of the throat; and in the third a slight amount of swelling confined to one tonsil, a little congestion of the pharynx, and, although no fever, there was just a little prostration. It seems, then, that with these six patients the scarlatina poison had lost its heat-raising property, and that even in two cases it had become only moderately heat-raising, whilst the vasomotor property (rash within the mouth, congestive sore throat, tracheal and laryngeal irritation, rash, and in three cases desquamation, etc.) was preserved almost completely.

The interpretation of the absence of fever in certain cases of scarlatina, considered as the result of the abnormal action of a toxin modified in its effects by the exaltation or diminution of the virulence, has nothing at variance with our actual knowledge of the biology of a certain number of microbes (influenza, typhoid fever, and colon bacillus). As regards the staphylococcus in particular, MM. Rodet and Courmont have shown that it can produce two toxins with quite opposite actions, the one depressing, the other producing convulsions. The Lyons school, the works of M. de Gendre, of M. Bouchard, etc., have placed prominently the possibility of certain pathogenic microbes secreting, according to their virulence, toxic substances with temperature-reducing or temperature-raising action; I shall not insist more on these too well established facts.

It follows, then, from all this *exposé*, that *scarlatina* is not synonymous with *scarlet fever;* the fever, and the general phenomena, do not form an essential part of the accompaniments of scarlatina; that the rash and sore throat become weaker in turn; that the desquamation (which is most frequently in connection with the rash) disappears or becomes difficult to recognise, and herein constitutes a very marked type—latent scarlatina, the paradoxical form in which the carrier of the disease is not "sick," but is all the same suffering from scarlatina.

If I have dealt at some length on non-febrile scarlatina it is because its study was indispensable in order to arrive at an accurate conception of the nature of latent scarlatina. This last is not, then, one isolated phenomenon in the natural history of scarlatina. It is connected by transition forms to the most classical type of scarlatina, and it will now be possible for us, thanks to the facts studied in the small epidemic, to set up a ladder, the rungs of which range in order of severity from the most characteristic cases of this disease to those which present the minimum amount of symptoms. Here, for example, is a gradation made out, one in which each stage has been drawn from one or more cases amongst the patients :

1. *Sore throat with white points*, buccal eruption, fever (103° F.), general phenomena (pulse 120° F., headache, drowsiness, lumbago, etc.), rash, desquamation of the tongue, skin, etc.

2. Simple attack of *congestion of the tonsils*, fever (102·2° F.), general phenomena less marked than in the preceding form, buccal eruption, *rash*, desquamation of the tongue and skin.

3. Scarlatinette—*indistinct sore throat* without redness, no buccal eruption, fever (101·3° F.), very few general phenomena, *rash*, no desquamation of the tongue, desquamation of the skin, medium in amount.

4. Non-febrile scarlatina—*indistinct sore throat*, without redness, a little debility, *rash* rather faint, desquamation branny and of very small amount from the body, but lasting some time from the feet and hands.

5. Latent scarlatina—(*a*) type with rash : *rash* slight, irritation of throat and trachea (?), vague headache ; (*b*) type with sore throat : sore throat, ordinary and very mild, slight redness of pharynx, a slight amount of fever, a little languor, no rash observed (but it does not necessarily follow that there was none).

From this scheme it can be seen that in the main the only constant phenomena, and, consequently, characteristics and specific signs of scarlatina, are the *sore throat* and the *rash*. The sore throat, in passing from congestion, slight swelling of the tonsils and slight dysphagia complained of by the patient without any noticeable alteration in the state of the back of the throat, very visible to the

physician, may take on any form, from the simple tracheo-pharyngeal irritation to the gravest form. The *rash* may last a more or less length of time, be of a hue more or less dark, but we believe that it is always present some time or other, whether it be on the skin or on the mucous membranes.

With two of the latent scarlatina cases, it is true, no eruption was noticed on the body, but both had redness at the back of the throat, a very indistinct rash on the buccal mucous membrane, the colour of which differed little from the ordinary lighter-coloured throat of children. And it must not be supposed that this change of colour was due to the turgescence of the congested tonsils, because during this epidemic I several times noticed that the large painful tonsils were of a pale rose-colour, as well as the back part of the buccal mucous membrane. The mouth rash is not dependent on the sore throat; it is an intrabuccal eruption. I have recognised it in two cases where the body eruption had apparently not occurred, and this was quite enough to enable me to say that one can quite well be suffering from scarlatina, genuine and infectious, without having shown any manifestations of the disease except the two symptoms of a vasomotor kind—very slight sore throat, very faint eruption on the body or within the mouth.

Such is latent scarlatina, which I should much prefer to see called *ambulatory scarlatina*, because on the whole the disease is not latent, but so attenuated in the general and local symptoms that the subject of it scarcely feels indisposed, or he may even not recognise his condition. There appears to be nothing illogical in this atypical form. It is only an attenuated form, which, under certain conditions, may insensibly be the means of conveying the gravest forms, and, as its whole history shows, is merely a question of the degree of virulence of the scarlatina poison. Lastly, to those who hesitate to admit such abnormal types of scarlatina, I would reply that cases of non-febrile and latent scarlatina have been in prolonged contact with fresh cases of scarlatina, and that they have not contracted the disease; and, besides that, in the numerous cases where the relationship has been clearly established, some latent cases have given rise to ordinary cases, which have also given rise to non-febrile cases, of which one, at

least, has in turn given rise to one almost classical in type. The latent cases which I have observed showed themselves, in fact, at the beginning of the epidemic. The passage of the toxin through different organisms exalted its virulence a little; but, as I have said, the disease was always benign, and in more than half the cases I saw attenuated forms of the disease (scarlatinette, scarlatina without fever, or ill-defined [*fruste*]). Compared with various other observations which I have been able to make in regard to previous epidemics of scarlatina, this ascertained fact has a certain amount of importance; and, besides, I am inclined to believe that the general character of an epidemic of scarlatina is not infrequently determined by that of the initial case, and if, in consequence, the pathogenic agent, with an exalted or lowered virulence, with which the infecting subject of a group of cases has not indeed given birth to infective agents of a virulence equally as strong as itself, or at any rate to cases practically equal of severity. And this remark in respect to scarlatina seems to me to apply equally to measles and influenza.

How often is latent scarlatina met with? We do not know at present. We have had to deal, in this essentially mild epidemic, with quite exceptional types, and which, perhaps, we shall never see again. That is a thing not at all likely, but the future will inform us on these points, and it is enough for to-day to have proved the existence of latent scarlatina—of *Scarlatina minima* reduced to two cardinal symptoms, extremely attenuated, but nevertheless recognisable.

It must, in the very great majority of cases, be impossible to diagnose latent scarlatina. The clinicians, few and far between, who allow the existence of this abnormal form have only diagnosed it retrospectively. During the time of an epidemic, many examinations may possibly lead to the recognition of some subjects having a slight eruption, suffering from a slight headache or sore throat, and allow these patients (sick without being aware of it) to be isolated immediately. Apart from the time of an epidemic, there is every chance that a medical man, not forewarned, will regard as unimportant and due to some commonplace cause a very slight erythema or indistinct sore throat, which are, however, in reality due to

scarlatina, and this is especially likely to occur where there are no general or local phenomena.

Whilst the differential diagnosis of a normal and well-marked case of scarlatina does not generally offer any difficulty, and that of scarlatinette is also easy, the non-febrile scarlatina, as well as the pale erythema of scarlatina, are liable to give rise to difficulties of interpretation. Firstly, one may ask if this scarlatina, without fever or latent, may not be clearly an erythema due to any other cause but scarlatina. One may hesitate, in fact, between this last and a scarlatiniform erythema (infectious erythema), erythema due to drugs, or pityriasis rubra. But in the first place the *infectious scarlatiniform erythema** supervenes during the recovery from other diseases (typhoid fever, diphtheria); next, it is late in appearance; then, again, it is polymorphous in the great majority of cases; finally, it is not followed by peeling, except in very rare cases. The *erythema due to drugs* (iodide, mercury, belladonna) will very frequently be easy to diagnose if one bears in mind that they have taken these drugs. As regards *pityriasis rubra*, this will be distinguishable from non-febrile scarlatina by its constant relapses, by the co-existence of rash and peeling, and, lastly, by the intensity of this latter symptom, accompanied by the shedding of the nails and loss of hair.

The slight erythema which I saw in a case of latent scarlatina was put down to the action of fresh air on the remarkably delicate white skin of a sandy-haired child. I draw attention to this mistake so that others may not again make it.

It seems to me that, with a case of this sort of erythema, it would be difficult to establish the diagnosis of it from an eruption due to food or drugs. The previous history and prolonged observation of the subject, and the co-existence of an epidemic of scarlatina, would probably materially assist.

So, then, by the side of the scarlatinette of Roger and the little-known scarlatina without fever, but having, nevertheless, maintained its right to be quoted, latent scarlatina must reclaim a place, still small, but one which by its consequences may become important.

* Concerning the important question of the connection of scarlatina with erythema scarlatinoides, *vide* Ch. Fiessinger, "Les Érythèmes Scarlatinoïdes," *Semaine Médicale*, 1893, pp. 332-334.

Entirely neglected by the old writers, who regarded as simple surmises the logical conclusions of Trousseau, it has been wholly ignored by clinicians, and that apparently because the persons suffering from latent scarlatina are not sick, or have but an ordinary slight sore throat. But that which it is difficult to explain is the silence of the epidemiologists of the profession. It seems that latent scarlatina has only been regarded by them as a flight of fancy, imagined by Trousseau and Graves, for explaining certain cases of empyema and certain cases of nephritis, inexplicable in themselves.

The old saying is very true, "One only finds what one looks for." Being persuaded *a priori* of the non-existence of latent scarlatina, they have not looked for it, and consequently have not found it. And yet what great interest this abnormal form would present if later researches should come to prove its frequency! Besides, what rôle may it not play in the sometimes so mysterious evolution of epidemics of scarlatina? Recently, in a highly intellectual medico-philosophical memoir,* M. Kelsch spoke of the frequent impossibility of tracing the source of infection in certain epidemics of eruptive fevers, which have developed without it being known from whence they were imported, and without contact with a previously suspected person. The epidemiology of scarlatina is peculiarly rich in obscurities of this sort, and in the face of the impossibility of tracking the infection, on account of the scattered condition of the distribution of cases in communities, the old director of Val de Grâce seemed disposed to give up the idea of the propagation of fever by the spread of the contagion, and to incline towards the idea of a capricious germination, perhaps even autogenesis.

Clearly, it would be ridiculous to make of latent scarlatina a sort of *deus ex machinâ*, capable of dissipating all the clouds, and throwing a beam of bright light into all the obscure corners of the etiology of scarlatina; but may it not be hoped that the study of cases improperly called latent will assist in the finding out of the source of origin and the prophylaxis of epidemics of eruptive fevers? How

* Kelsch, "Estimation of the Rôle of Contagion in Eruptive Fevers." Caducée, July 5, 1903.

many epidemics there are of which the origin has remained shrouded in mystery because the attention of the physician has only been called to the grave and confirmed cases! How many severe disinfecting precautions have remained inefficacious because an unrecognised case of scarlatina has contaminated next day the places disinfected over-night! Is there not need to further insist on the importance in epidemiology of the latent form from the point of view of the prophylaxis and etiology of scarlatina? to show that this thing henceforth is evident, that in certain cases scarlatina is essentially polymorphous, insidious, and masked?

The treatment of this *ambulatory scarlatinette* is without interest, but its prophylaxis is as indispensable as it is refined. One may say, however, that in order to render, in certain epidemics, disinfections and measures of prophylaxis a little less uncertain, the hygienist and the physician of fixed communities ought first of all to be persuaded that non-febrile, ambulatory, and marked cases of scarlatina do exist. It follows, then, as a corollary, one must keep a greater number of people under observation, and admit the most trifling sore throats, individuals who appear depressed, drowsy, or who complain vaguely of headache. Lastly, it is essential to examine the bare trunk of *all* those, without exception, over whom we have to exercise supervision. These proceedings will not prevent fresh cases of scarlatina from showing themselves, but if they happen, in certain cases, by means of an early diagnosis, to cut short an epidemic, the benefit is certainly not one to be despised.

THE SANITARY INSPECTORS EXAMINATION BOARD.

It is with much satisfaction we note the decision of the above Board to hold an examination in the provinces, the city of Liverpool having been selected for this purpose, in March next.

This, we trust, is the first step towards the establishment of several provincial centres for this purpose, and we hope the statutory recognition of the certificate, as in London, will shortly follow for provincial appointments.

THE ACID-FAST BACTERIA,

THEIR RESEMBLANCE TO AND DIFFERENTIATION FROM THE TUBERCLE BACILLUS.

BY

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INTRODUCTION.

THE discovery within the last few years of micro-organisms resembling the tubercle bacillus is of great interest to the bacteriologist and of vital importance to the physician.

A few years ago every acid-fast organism was either the bacillus of leprosy or of tuberculosis. Later it was shown that in the secretions of the normal skin, especially in the anal-genital region, there existed another organism, the bacillus of smegma, which very closely resembled that of tubercle in its general morphology, and particularly in its acid-fast character.

The power of resisting decolorization by mineral acids after being deeply stained was supposed to render the recognition of Koch's bacillus by means of the microscope easy and certain to all. The bacillus of leprosy is so infrequently encountered—at least, in this country—that its differentiation from the bacillus of tuberculosis was not of material importance.

To these two bacilli—the bacillus of leprosy and smegma—many new acid-resisting organisms, closely resembling and easily mistaken for those of genuine tuberculosis, have now been added.

Moëller, Petri, Rabinowitsch, Lubarsch, and many others have found several apparently different species of bacilli, which not only closely resemble the tubercle bacillus in form and size, but which retain the stain when, after being coloured according to Ziehl-Neelson's method, they are subjected to the action of acids and alcohol. They further resemble the true bacillus of tuberculosis in that when inoculated into animals they produce nodular or tubercular-like growths.

These acid-resisting or acid-fast organisms are very widely distributed in nature. They have been found with alarming frequency in butter, milk, and cheese, in the secretions and excretions of many herbivora, and also in normal and pathological secretions in man.

They have been seen in tonsillar exudation, in caries of the teeth, in the sputum from cases of non-tubercular abscess and gangrene of the lung.

Moëller has found them in grass, hay, pollen, dust of the stable, and in the dung of cattle.

Rabinowitsch found acid-fast bacilli in 28·7 samples of butter examined in Berlin and Philadelphia.

It would have been somewhat surprising if only the bacilli of tubercle and leprosy possessed this acid- and alcohol-resisting power, and even Koch[1] in 1884 stated that it was "not improbable that in time other bacteria may be discovered which have the same staining properties as the tubercle bacillus."

Lubarsch, Moëller, Bulloch, and many others have stated that the microscopical examination is now not sufficient for the diagnosis of tubercle. The last-named observer[10] states that "it would now appear that there are quite a number of bacilli which are as acid-fast to acids and alcohol as any genuine tubercle bacillus, and it must be acknowledged that this discovery has given a rude shake to the belief that the microscopical examination of the tubercle bacillus is in itself sufficient to establish a diagnosis of tuberculosis."

Even in pure cultures I can most emphatically say that many of these bacilli—not all—are, with the finest lens, indistinguishable from the genuine organism of tuberculosis. I have carefully examined most of these bacteria in pure cultures, and in their natural condition, after subjecting them to exactly the same method of staining, with a magnification of 2,250 diameter—*i.e.*, by means of an apo-chromatic $\frac{1}{12}$ objective, with No. 18 compensation eyepiece. As a result of such an examination, I can find some differences between the *majority* of the pseudo and genuine tubercle bacilli; but here and there are organisms which, as far as I can see, it is impossible to distinguish.

If this difficulty exists when we are dealing with a more or less

pure culture, and can compare under exactly the same conditions, it is evident that an occasional acid-fast bacillus in urine, sputum, or milk is, in many cases, absolutely indistinguishable from Koch's bacillus.

One has, further, to remember that the genuine tubercle bacillus varies very considerably in its appearance in the same culture or in the same specimen of sputum.

My attention was drawn to these tubercle-like organisms by my having found acid-fast bacilli resembling tubercle in the urine of three patients. I subjected the films, after treating with acid, to the action of alcohol, as this is generally advised as a means of eliminating the smegma bacillus. In both I diagnosed a tubercular disease. In one case this was confirmed by two leading English pathologists, but was disproved by a Continental bacteriologist. In the second case inoculation experiments with guinea-pigs gave absolutely negative results. In the third case, the after-history of the patient pointed distinctly to the non-tubercular nature of the disease.

I have therefore gathered from all available sources as much information as possible on these acid-resisting organisms, and have grown many of them, and by means of pure cultures have ascertained how far they resemble Koch's bacillus of tuberculosis. With a view of finding a differential method of staining, I have further made a series of experiments into the degree of resistance each species has to the ordinary decolorizing agents—*e.g.*, acids, alcohol, acid alcohol, etc.—and as a result have found what I consider to be a reliable method of differentiating all acid-resisting pseudo-tubercle bacilli from the genuine bacillus of tuberculosis.

In these pages I will give an account of the following acid-fast organisms:

The bacillus of tuberculosis, and its modifications.
The tubercle bacillus of birds and cold-blood animals.
The bacillus of leprosy.
The bacillus of smegma.
The bacillus of Timothy grass (Möeller).
The grass ii. bacillus of Möeller.
The mist or dung bacillus (Möeller).
The butter bacillus of Petri-Rabinowitsch and Korn.

In addition, some forms of acid-fast streptothrix—viz., that of Leishman and Birt, of Eppinger and Nocard.

I will then describe the morphological differences which exist between these; and, lastly, the results of my inquiry into their power of resisting acids, alcohol, etc.

The Bacillus of Tuberculosis, and its Variations.

As the tubercle bacillus is taken as the standard of the acid- and alcohol-fast organisms, I will briefly mention its most important characteristics, and the chief modifications which it can undergo under varying surrounding conditions.

Koch[1] described his organism as "invariably appearing in the form of small rods of the length of a quarter to a half the diameter of a red blood corpuscle (1·5 to 4 μ). Although the length varies, the breadth is pretty constant, provided that the same method of staining is used. The tubercle bacilli are not, as a rule, quite straight rods; they usually show slight bends or breaks, and often a gentle curve, which may increase in the longest forms to such an extent as to reach the first stage of corkscrew structure" (Bulloch). He also, in his original description, described them as containing oval spores, two to six being present in a single bacillus.

The actual measurement of the bacillus varies considerably. According to Lehmann and Neumann,[2] they are 1·5 to 4 μ long, and only 0·4 thick; according to Macé,[3] 1·5 to 3·5 μ long, having a general width of 0·3 μ. The latter points out that the width is much more uniform than the length, and that in preparations stained by Koch's method they usually appear a little thinner than by Ehrlich's.

They may be uniformly stained or present small uncoloured spots along their course, with darkly-stained parts between. The latter were at first regarded as spores, but, although far from being agreed, most authorities are of the opinion that no true spores are to be found in the bacillus.

These characters as regards shape and size are by no means constant, either in the organism met with in cultures or in

sputum. Sometimes they are very short, according to Macé little longer than broad; at other times they are very much larger, and may be swollen or clubbed at their extremities.

Metchnikoff, Nocard, Roux, Babes, Klein, and others have found giant forms, filament and thread forms, and true branching forms. These more or less exceptional forms are chiefly met with in old cultivations, but also occasionally in sputum. Moëller has seen true branching forms in tubercular sputum. My own experience, gathered from the examination of a very large number of phthisical sputa, is that the most common form met with is the uniformly stained rod, which varies somewhat in size; that the next in frequency is the beaded variety. In the sputum of one case I found that many of the bacilli had large nodules—usually one, sometimes two or three—situated generally in the middle, sometimes towards the end of the bacilli. These stained very deeply with the fuchsin, and were considerably wider than the body of the bacillus in which they lay. I have seen these very frequently in old cultures of human tubercle bacilli. I have occasionally, though rarely, met with indications of branching forms in sputum.

Metchnikoff,[4] who found the long, filamentous forms in sputum and in the splenic pulp of tubercular birds, considered that they did not represent evidence of degeneration, but that in all probability only a stage in the developmental cycle of a filamentous fungus. Hayo Bruns even thought that the aberrant forms belonged to the saprophytic vegetation of an organism which appeared in the form of rods in the parasitic stage.

Coppen Jones,[5] as a result of his researches, concluded that in tissues and secretions the organism occurs as a rod which reproduces by fission; that occasionally in sputum, and always in old cultures, filamentous forms, showing true dichotomous branching, occur, and these are found on the surface of the medium, whilst in the depths they are only rods. The rods, he thinks, do not contain true endospores.

Babes and Levaditi[6] found, on injecting rabbits with cultures under the dura mater, that in the infected areas only rod forms could be found during the first three weeks, but at the end of the

fourth week radiated forms, consisting of branched rods with clubbed ends, were met with.

Friedrich[7] and Nösske obtained these clubbed actinomycotic forms by injecting tubercle bacilli into the left ventricle of rabbits, and, unlike other observers, they obtained the best-developed radiated forms by the injection of the youngest and most virulent cultures—a fact which is adverse to the theory that these are retrograde forms.

Schultze[8] also found that virulent cultures produced the actinomycotic forms, and concludes that they do not represent evidence of attenuation of the parasite.

Lubarsch[9] (as we shall see later) obtained similar ray forms of growth by inoculation with the pseudo-tubercle bacillus, notably Moëller's Timothy bacillus, grass bacillus ii., and mist bacillus.

From these facts it seems natural that the tubercle and also the pseudo-tubercle bacillus should be classed among the higher fungi—the actinomyces. In favour of this is the further fact that one of the characteristics of the actinomycetes is the formation of nodular or granulomatous inflammation.

The *cultivation* of the tubercle bacillus presented at first considerable difficulty. Koch used blood serum; Nocard and Roux showed that the addition of glycerine to various media, especially to agar, facilitates the growth. "In all cases the isolation of fresh strains of tubercle bacilli is not easy, nor is it always possible in a given case. Apparently the main difficulty depends on the slow growth of the organism, so that if other and more rapidly-growing bacteria are present—and they frequently are—they may overgrow the medium and render it useless before the tubercle bacillus has begun its first division" (Bulloch[11]).

Pawlowsky found that glycerinated potatoes in sealed tubes formed a good medium, and this has since been largely used. Glycerine potato-juice, agar or bouillon, were recommended by Lubinski.

Hesse found that 0·5 per cent. of "Nahrstoff Heyden" (a soluble albumin) with 3 per cent. glycerine gave rapid growths from tubercular sputum in one to three days, and, according to Bulloch and Frankel, this is one of the best media.

The tubercle bacilli grow best at temperature of the human body, viz., 37° C., the minimal and maximal limit being 29° to 42° C.; therefore probably it does not thrive well outside the human body.

Czaplewski[18] found that he could get a growing culture of tubercle bacillus to show signs of an increased growth at the temperature of the room. I have also seen cultivations made by my friend, Dr. Arthur Ransome, grow at the temperature of the laboratory.

Moëller, by passing the tubercle bacillus through a blind worm, succeeded in growing them at 20° C.

The characteristic *staining reaction* of the tubercle bacillus depends on the fact that it is not easily stained, but when stained resists decolorization by mineral and organic acids. Koch originally succeeded by the addition of an alkali in staining it, but this method is not used now. Generally speaking, the tubercle bacillus is best stained by using a warm or hot solution of a strong basic aniline dye—*e.g.*, gentian violet or fuchsin—combined with a mordant—*e.g.*, aniline water or carbolic acid—the usual combination being aniline gentian violet (Ehrlich-Koch) or more generally carbolic-fuchsin (Ziehl-Neelsen). The various modifications of staining will be described later.

Preparations so stained are not decolorized by the use of 33 per cent. nitric or 25 per cent. sulphuric acid.

It has been proved that watery solutions of a basic dye, if used hot, can stain the bacillus, but the colour is only partially fast. Bulloch states that when stained in this manner the bacilli are decolorized within one and a half hours by a solution of sodium sulphate, whilst if aniline water solution of the dye has been used twenty-four hours' immersion in sodium sulphite is borne without effect. Further action of the sodium sulphite produces slow and unequal decolorization, so that parts of the bacillus—oval parts, situated mostly at the poles—retain the stain and are sharply demarcated. These egg-like bodies, Ehrlich says, may retain the stain under the influence of sodium sulphite for eight to ten days.

Ehrlich was of the opinion that the acid-fastness of the tubercle

bacillus was due to the presence of some substance surrounding the actual capsule, which is permeable for aniline, alkalies, etc., but impermeable for acids.

Koch[1] himself stated that it was "not improbable that in time other bacteria may be discovered which have the same staining properties as the tubercle bacillus." This is now known to be the case.

In addition to the various other acid-fast organisms to be described later, it would be well to mention that some structures other than bacteria are acid-fast, amongst others, the outer layer of the epidermis, certain hairs, the capsule of the coccidium oviforme, and the ova of tape-worms (Bulloch). According to Czaplewski, certain keratinized cells and the nuclei of mast cells resist partial decolorization (Macé[3]).

The acid-fast power of the tubercle bacillus was thought to be due to the presence of fat in the bacillus, and Dorset recommended the use of Sudan iii., a fat stain, as a means for staining the bacillus.

Aronson,[12] in 1898, definitely showed that the *saurefestigkeit* is due to the presence of a substance of the nature of wax. If the bacilli are treated with a mixture of alcohol and ether they still retain their power of resisting acid; but if hydrochloric acid is added to the mixture, they are no longer, according to Bulloch, acid-fast.

Aronson and Weyl found that the substance extracted from the bodies of the bacilli by treating with boiling xylol, chloroform and benzine is very markedly acid-fast.

Borrel found that, after removing, by prolonged action of warm xyol, the waxlike substance, the tubercle bacilli had lost their acid- and alcohol-resisting power, although they were still capable of producing disease.

Removal of fat alone does not affect either the form or staining reaction of the bacilli.

McLeod and Bulloch have isolated this waxlike substance both from the tubercle and Timothy grass bacillus.

Bulloch,[11] as a result of his experiments, draws the following conclusions: That the tubercle bacillus, though usually in the

form of rods, may be filamentous, clubbed, or like the actinomyces; it is difficult to grow, is not adapted for a saprophytic existence, and requires high temperature for growth. Under all conditions it is acid-fast, due to the presence of a waxlike body.

Klein[19] and Marmorek[20] have found that quite young tubercle bacilli are not resistant to acids and alcohol. The latter thinks that this is due to the fact that young tubercle bacilli are not covered with the fatty or waxy envelope which prevents the ordinary basic pigments easily coming in contact with the bacillus, and which, when stained, prevents acids and alcohol from decolorizing them. Klein suggests that the chemical substances which are ordinarily present in tubercle bacilli, rendering them resistant to acids, are absent from very young bacilli.

MODIFIED TUBERCLE BACILLI: AVIAN TUBERCLE.

In the tubercular disease of birds, bacilli are found which correspond in their morphological characters and staining reactions with those in mammals, but differ in cultures and experimental inoculations. These organisms were first distinguished from the tubercle bacillus by Maffucci.[13]

Fischel[14] says that both mammalian and avian tubercle bacilli are one and the same kind as regards nutritive media. He succeeded in getting the tubercle bacilli of mammals acclimatized to a higher temperature, and on some media obtained similar cultures, but he was unable to transfer one to the other as regards their pathogenesis. In guinea-pigs he was able, by injecting avian tubercle bacilli, to induce a general tuberculosis, but cultures obtained from this animal were not identical with those of avian tubercle.

Avian tubercle bacilli must be regarded as only a form of the mammalian tubercle which has become accustomed to the higher temperature of birds, but which is also occasionally pathogenic for other animals. It requires a higher temperature for its growth —42° C., or a minimum and maximum of 35° to 45°. Cultures of bird tubercle have generally a damper and smoother growth on artificial media, but exceptions to this are not infrequent.

Lubarsch[9] recognised three forms of growth:

1. Damp, smooth, and easily disintegrated colonies of a slimy consistence.

2. Dry, wrinkled skins which are not easily rubbed apart.

3. Cultures which are indistinguishable from those of mammalian tubercle.

He remarks that in one and the same culture different forms of growth may appear by further cultivation. Krase[21] found that cultures which at first resembled closely those of tubercle bacilli became damp and soft later, whilst Lubarsch has frequently noticed that colonies which were at first damp became under further cultivation, especially on agar-agar, drier and wrinkled.

In such cultures he met with true branching and large, club-shaped forms. Lubarsch found that when injected into guinea-pigs, after considerable time had elapsed the bacilli could be found in the infected tissues arranged in a radial manner, as is the case with the pseudo-tubercle bacilli.

Tubercle Bacilli of Cold-blooded Animals.

Tuberculosis in cold-blooded animals is to be regarded as a modification of tuberculosis in mammals (Moëller).

Dubard and Bataillon[15] cultivated an organism resembling the tubercle bacillus from a tumour of a carp, which is acid-fast, forms branches, and grows at a temperature of 23° to 25° C. with a minimum of 12° C. They proved that this bacillus is the tubercle bacillus acclimatized to cold-blooded animals by inoculating and feeding fishes and frogs with cultures of human and avian tubercle, and from the organs of such fish the bacillus piscicola was obtained.

Lubarsch found that the tubercle bacilli of fishes produced pathologically about the same effect as the tubercle bacillus from a blind worm, and only once did he find bacilli arranged in a radial manner. He also was able to modify the tubercle bacillus of mammals by passage through frogs, so that they grew at a temperature of 28° to 30° C.

Moëller[16] isolated from the spleen of a blind worm, which had

a year previously been injected with human tubercular sputum, cultivations of tubercle which flourished at 20° C Cultures of these, Lubarsch states, instead of being dry and crumbly, were damp with shiny white surface. They do not grow at 28° to 37° C., but grow best at a temperature of 22°. Morphologically, they are indistinguishable from tubercle bacillus, and cultures according to Moëller, resemble those of bird tuberculosis.

They cannot be inoculated into rabbits.

(To be continued.)

THE ROYAL INSTITUTE OF PUBLIC HEALTH.

A MEETING of the Council of The Royal Institute of Public Health was held at 19, Bloomsbury Square, W.C., on Wednesday, October 21, 1903, at 4.30 p.m. The President, Professor WILLIAM R. SMITH, M.D., in the chair.

Letters of regret at their inability to attend were read from Professor John Glaister, M.D., C. A. James, Esq., Alexander Johnston, Esq., M.D., and Sir James Russell, M.D.

The minutes of the last meeting were read and confirmed.

The minutes of the Finance and Executive Committee were read and confirmed.

The Treasurer reported that the balance at the bank was £929.

The Council resolved to invite H. S. Wilson, Esq., B.A., M.D. Cantab., of King's College, to accept the appointment of Honorary Librarian.

The President reported that he had sent a telegram of congratulation to Field-Marshal the Earl Roberts, O.M., K.G., K.P., V.C., an Honorary Fellow of The Royal Institute, on the occasion of his birthday, which had been graciously acknowledged.

The following were elected Members of the Institute:

As Fellows:

PROFESSOR CHARLES SCOTT SHERRINGTON, M.A., M.D., F.R.S.
Professor of Physiology in the University of Liverpool.

SIR HERMANN WEBER, M.D., F.R.C.P.

PROFESSOR GERMAN SIMS WOODHEAD, M.A., M.D., F.R.S. Edin.
Professor of Pathology in the University of Cambridge.

As Associate:

EDWARD JAMES BISHOP.

(*Signed*) JAMES CANTLIE,
Honorary Secretary.

BACTERIOLOGICAL NOTES.

I.

"PARA-TYPHOID" INFECTIONS.

BY

R. TANNER HEWLETT, M.D., M.R.C.P., D.P.H.,
Professor of General Pathology and Bacteriology in King's College, London, etc.

THE increasing minuteness of clinical observation, assisted by improved physical, chemical, and bacteriological methods of investigation, together with the multiplication of records, both clinical and pathological, have served during the last century to differentiate many diseases formerly believed to be identical. The most notable instance of this, and known to everyone, was the separation by Sir William Jenner of typhus fever into the two diseases now known to us as typhus fever and typhoid, or enteric, fever. Certain skin eruptions, formerly regarded as identical are now regarded as being diverse diseases. More recently, by the use of the agglutination reaction, cases of long-continued fever, occurring in India and elsewhere, and regarded as typhoid fever, have been shown to be really cases of Malta fever. It is no wonder, therefore, that typhoid fever should be more critically studied than heretofore, and already another class of cases, simulating it closely, has been distinguished, and probably the process of differentiation will proceed still farther in the future.

These typhoid-like cases have received the not altogether appropriate name of "para-typhoid."

In 1898 Gwyn* reported a remarkable case, simulating typhoid fever, that occurred in Professor Osler's clinic. The patient was admitted to hospital on October 11. He had been ill since September 17 with headache, fever, vomiting, diarrhœa, and abdominal pain. On October 14 noisy delirium set in; on October 17 the patient had three hæmorrhages from the bowel. He slowly rallied, and went out in five weeks. Rose-spots were

* *Johns Hopkins Hosp. Bull.*, ix., 1898, p. 54.

present; the spleen was palpable; the urine gave the diazo reaction; and the temperature was that of a severe typhoid fever. But the agglutination reaction with the typhoid bacillus was never given by the patient's blood. Cultures made from the blood on October 12 gave a small, actively motile bacillus, which decolorized by Gram's method. It fermented glucose, but not lactose; formed a brownish yellow, moist growth on potato; and gave, primarily, acid-formation in milk, with a subsequent return to the original reaction. The bacillus was evidently not the typhoid bacillus, but belonged to the *Bacillus enteritidis*, or Gärtner group. The serum of the patient agglutinated this bacillus in dilutions up to 1 in 200, but was practically without action upon the typhoid bacillus. On the other hand, typhoid sera of agglutinative strengths (upon the typhoid bacillus) of 1 in 300 to 1 in 1,100 were without effect upon this bacillus even in dilutions of only 1 in 2.

In a case of supposed post-typhoidal osteomyelitis Cushing* isolated another of these "para-typhoid" bacilli. Nine months before admission the patient had suffered from a prolonged febrile attack, extending over a period of ten weeks. It was regarded as typical typhoid, and there was a distinct relapse. Subsequently a nodule appeared near the breast-bone, and broke, discharging pus, and leaving a sinus, for the cure of which he was admitted for operation. Cultures made from the sinus at the time of operation gave a bacillus closely resembling that isolated in the previous case recorded above, and agglutinated by the patient's blood in high dilution.

Hume† reports a case admitted to the Liverpool Royal Infirmary which, although simulating typhoid fever closely, gave a negative agglutination reaction with the typhoid bacillus. The spleen was palpable; there were numerous rose-spots, severe diarrhœa, with hæmorrhage from the bowel. From the stools and from the urine a bacillus similar to those detailed above was isolated. The patient's blood agglutinated it in dilutions up to 1 in 200, but did not agglutinate the typhoid bacillus.

Hume, in this paper, gives an interesting summary of fourteen

* *Johns Hopkins Hosp. Bull.*, 1900, p. 156 (Bibliog.).

† *Thomson Yates Laboratories Report*, vol. iv., part ii., 1902, p. 385 (Bibliog.).

cases of "para-typhoid" infection that he has collected from the literature.

Luksch* describes another case of severe "para-typhoid" in which a post-mortem examination was obtained. The patient, twenty-five years of age, was brought into hospital in a serious condition, semi-comatose, and with petechiæ and scattered rose-spots over the body. The spleen was enlarged, and diarrhœa was present. The history given was that the patient had been feeling ill for a week, and had kept his bed for four days. His blood gave a positive agglutination (Widal) reaction in a dilution of 1 in 40, with three strains of typhoid bacilli. After being in hospital for two days, during which time the temperature ranged between 100° and 102° F., the patient died. At the post-mortem the spleen was found to be enlarged, and dark red in colour. Neither the solitary glands nor the Peyer's patches were enlarged or ulcerated. From the gall-bladder, but not from the spleen, a bacillus was isolated which did not correspond either to the typhoid bacillus or to the colon bacillus. The bacillus was a short, motile rod, not staining by Gram's method. A small amount of gas was produced in glucose agar; milk was not curdled, and no indol was formed. On potato, a brownish, slimy layer developed. Litmus milk was first acidified, and subsequently rendered alkaline again. In all these characters it resembled the *B. enteritidis* (Gärtner) bacillus, and evidently belonged to that group.

The agglutination reactions obtained are of interest. As before mentioned, the patient's blood agglutinated the typhoid bacillus in dilutions of 1 in 40, but, when further tested, not in dilutions of 1 in 200. Tested on the bacillus isolated from the patient, it agglutinated well in dilutions of 1 in 400. Tested with typhoid blood, this bacillus was not agglutinated in dilutions of 1 in 100. The case, therefore, differed from a case of true typhoid fever in the following respects: There was no enlargement of the lymphatic elements of the intestine, so characteristic a lesion in typhoid; no bacillus was isolated from the spleen, while in typhoid the typhoid bacillus is best isolated from the spleen;

* *Centr. für Bakt.*, xxxiv., "Originale," No. 2, p. 113.

the bacillus that was isolated from the gall-bladder (also from the lungs) belonged to the *B. enteritidis* group, the typhoid bacillus not being isolated; and, lastly, the anomalous agglutination reaction.

There can be no doubt, therefore, that typhoid fever may be completely simulated by these cases of "para-typhoid" infection, and some of the cases of supposed typhoid which do not yield the agglutination (Widal) reaction doubtless belong to this class of disease.

II.

BACTERIOLOGICAL NOTES FROM FOREIGN JOURNALS.

LE MAL DE CADERAS OR FLAGELLOSE PARÉSIANTE OF SOUTH AMERICAN HORSES. DR. ELMASSIAN, Director of the Bacteriological Institute of Paraguay, and DR. MIGONE, Assistant. (*Annals of the Pasteur Institute*, April, 1903.)—This article signalizes a new disease due to a trypanoosme, and the increase of the geographical area subject to trypanosomatous infections among cattle. The author gives a detailed description of the parasite, and notes the different forms which the disease occasioned by it may take.

HYDROPHOBIA (RABIES) IN SOUTH AFRICA. BY ADRIEN LOIR. (*Annals of the Pasteur Institute*, April, 1903.)—The author gives an account of his mission in Rhodesia, where he was sent by the Pasteur Institute at the request of the Chartered Company in order to start an anti-rabic institute against the epidemic of rabies, which had made its appearance between the Zambezi and the Transvaal.

Dr. Loir gives historical details regarding the epidemic. According to the natives, this disease existed in Rhodesia thirty years ago, then it disappeared. In 1892 and 1893, at Port Elizabeth in the Cape Colony, there was an epidemic of rabies, imported from England by a dog. The first case occurred in August, 1892, and the last case in August, 1893.

It is probable that the epidemic had spread from Port Elizabeth to the neighbourhood, but, remaining quiescent, it passed unperceived. The European population is not dense in South Africa; during the Boer War it was not possible to ascertain the diseases from which the animals suffered, or even those from which men suffered. Then, too, owing to the form which the disease takes in warm countries, where the rabid period of the disease is much shorter, the existence of rabies in these countries was often denied.

In the north of the Zambezi, in 1901 Lewanika, King of Barotseland, had killed all the dogs belonging to his subjects, on account of the epidemic which had raged for two years.

In the French Congo this disease appears to be unknown. Thanks to the severe measures taken (in Rhodesia), it will not be long before the epidemic will be diminished; but it is to be feared that it will not be possible to cause its disappearance, owing to the numerous wild animals and the scattered population.

At the end of his mission, Dr. Loir proposed the establishment of a pound, which would have relieved the prescribed measures, which are often vexatious.

For the inoculations Dr. Loir applied the ordinary Pasteur method, with the convenient modification of Dr. Calmette, which necessitates inoculating only three or four rabbits per month.

In three months eleven Europeans and natives who had been bitten were treated by the Pasteur method at Bulawayo.

Tetanus Antitoxin.—Ulrich has collected 113 cases of tetanus, in 41 of which antitoxin was administered within thirty hours of the first appearance of symptoms. The mortality was over 72 per cent., but in 72 cases in which the antitoxin was administered between the second and fifth days the mortality was less than 46 per cent. This shows that the antitoxin is unable to destroy the firm union of the toxin and the cells of the central nervous system, though capable of neutralizing any "floating" toxin in the circulation.

CHEMICAL NOTES.

EXAMINATION OF MILK SERUM BY MEANS OF ZEISS' IMMERSION REFRACTOMETER. H. MATTHES and F. MULLER. (*Zeit. für öffentl. Chem.*, 1903, ix., 173-178.)—The serum of spontaneously curdled milk should give a reading of at least 40 scale-degrees when examined by this instrument (*Analyst*, 1903, xxviii., 91), the temperature of the serum being 17·5° C. at the time of the observation. Readings below 40 indicate the presence of added water to the original milk. The authors find that each 10 per cent. of added water depresses the reading by 2·5 scale-degrees. Each degree of temperature above 17·5° decreases the reading by 0·2 scale-degrees, but it is advisable to always employ a temperature of 17·5 C., as this correction is not an absolute constant. Analyses of forty-eight samples of milk are given, the results showing that the refractometer supplies a ready means of detecting adulteration with water.

NEW TESTS FOR DISTINGUISHING RAW FROM HEATED MILK, AND FOR THE DETECTION OF HYDROGEN PEROXIDE IN MILK. C. ARNOLD and C. MENTZEL. (*Zeit. für Untersuch. der Nahr. und Genussmittel*, 1903, vi., 548, 549.)—On adding a drop of hydrogen peroxide and 6 to 8 drops of a 2 to 3 per cent. alcoholic solution of *p*-diethyl-*p*-phenylenediamine to 10 c.c. of raw milk a fine red coloration is produced, which gradually turns violet. Two per cent. of raw milk in heated milk gives the coloration within three minutes. A feebly acid alcoholic solution of *p*-diamido-diphenylamine hydrochloride gives a blue-green coloration under similar conditions. Conversely, the tests are applicable for the detection of hydrogen peroxide in raw milk. These two substances give colorations with chlorine, bromine, nitric oxide, and ozone, but not with hydrogen peroxide except in the presence of oxydase.

ON THE DETECTION OF SACCHARIN IN BEER, WINE, ETC. C. BOUCHER and F. DE BOUNGNE. (*Bull. de l'Ass. belge Chim.*, 1903, xvii., 126, 127.)—In order to simplify the detection of saccharin, the authors have devised the following method of decolorization: 100 to 200 c.c. of the beer are treated with a 1 per cent. solution of potassium permanganate and several drops of

sulphuric acid, preferably without warming the liquid. After decolorization is complete the excess of permanganate is destroyed by means of sulphur dioxide. In the case of wines the liquid is heated on the water-bath, and complete decolorization is not necessary. After cooling, the decolorized beer or wine is extracted with two portions of 25 c.c. of ether, the ethereal extracts united and evaporated, and the usual tests for saccharin applied to the residue.

THE ARTIFICIAL METHOD FOR DETERMINING THE EASE AND THE RAPIDITY OF THE DIGESTION OF MEATS. H. S. GRINDLEY and T. MOJONNIER. (*University of Illinois Publications*, 1900, i., [5], 1-20.) —The following results were obtained in the course of an investigation on the nutritive values of raw and cooked meats. The process employed consisted in treating weighed quantities of meat (corresponding to about 1 gramme of dry substance) in small beakers with 100 c.c. of pepsin solution containing 1·25 grammes of pepsin per litre of 0·33 per cent. hydrochloric acid. The beakers were placed in a water-bath kept at a temperature of 38° to 40° C., and the digestions allowed to proceed for various lengths of time, the contents of the beakers being frequently stirred. After the lapse of one, two, four, and six hours, series of the beakers were removed from the water-bath, 10 c.c. of formalin were added to each to stop the further action of the pepsin, and the solutions filtered. The nitrogen in the undissolved residue was then determined by Kjeldahl's process. The figures in the table (averages of a considerable number of experiments) show the amounts of nitrogen digested, the total nitrogen in the original meat being represented by 100. The meat experimented with was lean round of beef from an animal three years old.

Treatment of Meat used.	Digested for 1 Hour.	Digested for 2 Hours.	Digested for 4 Hours.	Digested for 6 Hours.	Digested for 24 Hours
Raw beef	86·37	91·25	94·31	95·29	96·73
Pan-broiled beef	75·99	86·48	93·91	95·04	95·35
Fried in lard	75·50	82·75	88·75	91·93	94·58
Boiled two hours at 80° to 85° C.	89·46	91·92	95·26	96·94	96·58
Boiled five hours at 80° to 85° C.	85·62	89·64	95·17	95·08	95·23

It is plainly evident that there is a difference in the ease and rapidity of the digestion of the proteids of raw meats and of meats cooked by the common methods. The differences are best seen in the results obtained by digesting the meats for one hour. Afterwards the differences gradually disappear, until, at the end of twenty-four hours, the digestibility of raw and cooked meats is practically the same.

The hydrochloric acid solution alone, without pepsin, was found to dissolve in twenty-four hours in the case of raw beef from 12·08 to 23·42 per cent. of the total proteids, and with boiled beef from 8·98 to 13·99 per cent.

NOTES ON WENZELL'S REACTION AND OTHER REACTIONS OF STRYCHNINE. G. GUÉRIN. (*Journ. Pharm. Chim.*, 1903, xvii., 553.) —Wenzell's reagent ($KMnO_4$ in H_2SO_4, 1 : 200) is usually regarded as one of the most characteristic tests for strychnine, but the absence of other alkaloids and foreign organic bodies is usually essential. A blue or bluish coloration is also given by tartaric and citric acids, tartrates, citrates, and thiocyanates, though of less intensity than that produced by strychnine. These substances do not react, however, with the reagents of Mandolin and Kundrat (0·5 and 1 per cent. solutions of ammonium vanadate in sulphuric acid), or with the sulphuric acid solution of cerium oxide prescribed by Sonnenschein. The bichromate and sulphuric acid reagent gives no coloration with thiocyanates, but a persistent green colour with tartaric and citric acid and their salts, which cannot, however, be confused with the fugitive blue colour given by strychnine.

THE DETERMINATION OF MORPHINE IN OPIUM. E. LÉGER. (*Journ. Pharm. Chim.*, 1903, xvii., 553-560.)—The following modification of Loof's method is recommended by the author as the most accurate and rapid of the published methods: Six grammes of the powdered opium dried at 60° C. are mixed with 48 c.c. of a 2 per cent. aqueous solution of sodium salicylate in a stoppered flask, which is vigorously shaken for five minutes, and then allowed to stand for one hour with occasional agitation. The mass is then expressed in a linen cloth, and 36 c.c. of the liquid filtered into a small stoppered flask and mixed with 4 c.c. of ether and 1 gramme

of ammonium hydroxide (*Codex*). The flask is well shaken for ten minutes, and then set aside for twenty-four hours, at the end of which time the morphine will be found as a white, non-adherent deposit. This is transferred to counterpoised filters (the flask being washed out with 8 c.c. of water), washed three times with water, which is kept in the funnel for five minutes by means of a rubber tube and pinchcock on the stem, and dried on the filters at 100° C. The crystals are then washed with three portions of 8 c.c. each of benzene, again dried at 100° C., and weighed. The amount of morphine thus obtained should be 0·45 to 0·495 gramme, corresponding with about 10 to 11 per cent. in the drug. Duplicate determinations made by the author on the same sample of opium by this method gave (1) 10·28 and (2) 10·37 per cent. of morphine.

THE DETERMINATION OF FORMALDEHYDE IN AIR. G. ROMYN and J. A. VOORTHIUS (*Bull Soc. Chim.*, 1903, xxix., 540-543.)—Nessler's reagent is rapidly reduced by formaldehyde with the formation of metallic mercury, as in the subjoined equation (*cf. Analyst*, xxi., 98):

$$HgI_2 2KI + CH_2O + 3KOH = Hg + 4KI + HCOOK + 2H_2O.$$

The precipitate, whose colour depends on the quantity of substances used, can be rapidly and completely oxidized by means of a solution of iodine in potassium iodide, followed by the addition of a small amount of hydrochloric acid. The amount of formaldehyde can thus be calculated from the quantity of free iodine found in the liquid after the oxidation.

For the determination of formaldehyde in air, a slow current is passed through Nessler's reagent contained in a Pettenkofer's or Kyll's tube. The standard solution of iodine is then introduced, and the liquid shaken until the precipitate has dissolved, and then, after the addition of a few drops of dilute hydrochloric acid, titrated with $\frac{N}{20}$ thiosulphate solution.

According to the equation, 30·16 milligrammes of formaldehyde react with 1 molecule of mercuric iodide, or the amount of Nessler's reagent produced by 271 milligrammes of mercuric chloride.

About 5 c.c. of the reagent are required to oxidize 21 milligrammes of formaldehyde, corresponding with 13 c.c. of $\frac{N}{20}$ thiosulphate solution.

NOTE ON PERKIN'S TEST FOR BICARBONATES. FRANCIS O. TAYLOR. (*Journ. Amer. Chem. Soc.*, xxv., 537.)—The author has found that even small quantities of ammonium salts absolutely vitiate Perkin's test for bicarbonates (*Journ. Soc. Chem. Ind.*, 1902, xxii., 1375), which depends on the liberation of bromine from a solution containing a bromide and hypochlorite. Consequently ammonium bicarbonate will not give the reaction.

ULSCH'S METHOD FOR ESTIMATING NITRIC ACID. F. STOLBA. (*Casopis pro prumysl chemicky*, 1903, xiii., 171; through *Chem. Zeit. Rep.*, 1903, 158.)—The author has obtained high results when working this process, and has discovered the cause to be nitrites in the sodium hydroxide. These nitrites probably come from the sodium nitrate which is used in the manufacture of the hydroxide to remove ferrocyanides, sulphites, etc. Before using it in the Ulsch process, therefore, potassium or sodium hydroxide should be examined by distillation with aluminium.

DETECTION OF "CALF-CREAM" IN MILK. F. LAUTERWALD. (*Zeit. für Untersuch. der Nahr. und Genussmittel*, 1903, vi., 544-548.) —A Dutch firm having recently placed on the market an article called "Calf-cream" (Kalf-room), which, when dissolved in water and mixed with separated milk, yields a product closely resembling whole milk in appearance and giving analytical results agreeing with those of a genuine milk, the author discusses means for detecting this adulterant. It consists of a mixture of freshly precipitated casein, cane sugar, and earth-nut oil. As nearly all commercial earth-nut oil gives the reaction for sesamé oil when Baudouin's test is applied, this affords the most ready means for detecting "Calf-cream." A solution of 50 grammes of "Calf-cream" in 100 c.c. of warm water mixed with 500 c.c. of separated milk gave a mixture which, on analysis, was found to contain 3·43 per cent. of fat and 13·28 per cent. of dry solids. The fat showed a distinct reaction with Baudouin's test. Bömer's phytosterol acetate test is also useful.

AN ADULTERATION OF COFFEE. J. GONNET. (*Ann. de Chim. anal.*, 1903, viii., 259, 260.)—The author has met with a commercial sample of roasted coffee to which had been added a mixture of

sugar and iron sesquioxide (hæmatite). When such adulteration is suspected by reason of the ash being too high, the coffee-beans should be boiled with water and any deposit examined.

English Patents.

Method of, and Mechanism for, distributing Sewage and other Liquids. J. E. Willcox and H. P. Raikes, Birmingham. (*Eng. Pat.*, 2,155, January 27, 1902.)—A rectangular filter-bed is provided with a central or side sewage carrier or trough, and a travelling sewage distributor fed from it, the distributor being so arranged that it travels over the area of the filter on one side of the trough, distributing the sewage uniformly during the whole forward travel, whilst on the backward travel the sewage is distributed over the other side of the trough. Thus a uniform application of sewage, with equal intervals of rest, is given to every portion of the filter at stated periods.

Improved Plant and Apparatus for distributing Sewage or other Liquid. J. B. Alliott and H. B. Ransom, London. (*Eng. Pat.*, 4,029, February 17, 1902.)—In order to distribute sewage or other liquid uniformly over a rectangular bed by means of a revolving distributor, the corners of the bed are provided with supplementary distributors fed by the travelling radial arm or arms. Such distributors may comprise a trough having in plan the form of a circle, either broken or continuous, with branch troughs extending into each corner. If the distributor is of the type which is moved to and fro along the bed, and is fed from a central trough, the distributing channel may be composed of several slotted pipes, each flanged at both ends, and so fixed that the pipes may be turned about their axes and the position of the slots varied. If the distributing channels are carried by an endways movable trolley, buffers or inclined rails are provided at each end of the track to facilitate the starting of the trolley on its return journey. Arrangements are also provided for automatically controlling the supply of sewage to the channels.

REPORT OF A COMMITTEE OF THE ROYAL COLLEGE OF SURGEONS OF ENGLAND ON PHYSICAL DEGENERATION.

THE Council of the Royal College of Surgeons of England have carefully considered the circular drawn up by Sir William Taylor, Director-General of the Army Medical Service, on the physical deficiencies of the men who offer themselves for enlistment in the Army; and now beg to submit, for the information of the Secretary of State, the following observations in reference to those matters upon which their opinion is invited, viz.: (*a*) the necessity of a proposed inquiry into the causes of physical deficiency, and as to the best available means of remedying defects and improving the national health; (*b*) the ground to be covered by the Commission if appointed; and (*c*) the composition of the Commission.

It is premised in the circular of the Director-General that, while there is reason to believe the physique of the well-to-do classes is improving, "a very large proportion of the men who offer themselves for enlistment in the Army are found to be physically unfit for military service"; and there seems to be a presumption that the proportion is increasing. But the statistics set forth in the circular do not support this view, and there is no indication that the figures are affected by any change in the standard of physical requirements in recruits during the period under consideration. Nor does it appear that there has been any noticeable change in the personnel of the candidates for enlistment during this period. In the opinion of the Council, however, there are reasons for believing that, compared with former times, most of the men who now offer themselves as recruits are drawn from a class physically inferior, and that a general statistical statement may be, therefore, misleading.

Many influences have been at work during recent years to affect the status of the working classes. Increased competition in trade, keener industrial rivalries, the growing responsibilities of employers, the "labour movement," trades unions, and other social and economic factors, have altered the conditions of labour, and raised at once the comparative standard of efficiency of the workman, the standard of living, and the rate of wages. In the struggle for employment the better educated, the more intelligent, and the more active and industrious are attracted to the better paid and more coveted occupations. The result is a large and probably growing *remainder* of those who, more or less unfit, fail to obtain regular employment. And it is apparently from this residue that the Army has to obtain the larger proportion of its recruits.

Disquieting though this reflection may be, there is no evidence before the Council that the physical disabilities of this class, taken by itself, have increased or are increasing. Indeed, the data supplied by the circular itself seem to show that they have not increased, but, rather, that they may tend to diminish.

From Table I., p. 2, it would appear that when recruits belong to a class which may be regarded as first-hand material — namely, "boys under seventeen years of age"—the proportion of rejections is only 11·2 per cent. Considering the probable parentage and the early surroundings of these youths, and considering also the numerous possible physical disqualifications, this cannot be regarded as a high rate of rejection. Moreover, this class of recruit affords a fair criterion of the average physique of the lower stratum of society. And it is also this class of recruit which should manifest most improvement under the favouring

conditions of better food, better housing, and better surroundings and associations after enlistment.

Again, Table II., p. 3, shows a steadily declining rate of primary rejections—from 40·6 per cent. in 1893 and 41·6 per cent. in 1896 to 27·4, 28·0, and 30·7 respectively in the three years 1900-1902. Against this is to be set a sharp rise in the years 1901 and 1902 in secondary rejections—that is, rejections within three months of enlistment and after two years' service. The causes of these secondary rejections are not stated; but it may not unreasonably be assumed that many of them were due to preventable causes, physical or moral.

As bearing generally on the larger question of National Health, and more particularly on the physique of those who offer themselves as recruits, Table III., p. 4, is not without some hopeful indications as to the future. The table shows a diminishing proportion of rejections in each of the assigned grounds of disqualification, excepting that of "loss or decay of teeth." In such a critical test of physique as "chest measurement," the rejections, which were 139·64 per 1,000 in 1896, were only 49·88 and 56·72 respectively in the years 1901-1902. "Imperfect constitution and debility" caused 18·40 per 1,000 rejections in 1891, and only 3·36 and 3·91 respectively in the years 1901-1902. On the other hand, the rejections due to loss or decay of teeth, which were 10·88 per 1,000 in 1891, had risen to 49·26 per 1,000 in 1902.

The circular does not state whether or not there has been increased stringency of late in the matter of the teeth, or relaxation with respect to the other physical and vital requirements. In the absence of any statement to the contrary, the Council assume that no material alteration has been made. In any case, the Council believe that many of the causes of disability will tend to grow less. Greater attention is now paid in schools to the general health of children, to physical training, to the care of the sight, the hearing, and the cleanliness of the mouth and teeth. And the spreading influence of the various social, municipal, and philanthropic agencies for the promotion of the public health, and the strengthening of the character of the individual, cannot fail to beneficially affect the health and well-being of all classes of the people including the lowest.

It may, perhaps, not be altogether irrelevant to remark that many of the grounds of physical disqualification for the English Army, such as defects in vision, weight, height, and teeth, would, in countries where conscription obtains, be much less important factors in judging of the fitness of men for military service.

The Council desire to state that, while they have thought it right to scrutinize the data supplied in the circular prepared by the Director-General, they have not done so in a captious spirit, but rather to illustrate the difficulty they have experienced in forming an opinion or in making any definite recommendation. They cordially recognise the immense importance of the matters to which the Director-General has called attention, and the skill and clearness with which he has collated the facts upon which his opinion and recommendations are based.

On the evidence before them, and in view of the testimony of the public health statistics, the Council do not think there is need for a large inquiry into the National Health, and they are doubtful whether trustworthy results would be obtained by instituting a special inquiry with respect to the class from which most of the recruits are obtained. The Council are, however, of opinion that much might be done in a less formal manner by emphasizing the necessity of still stricter attention to the health, feeding, and training of school children, and more especially the care of the teeth and the arrest of threatened or early decay.

The Council are also of opinion—upon which opinion they would lay great stress—that as much as possible should be done to promote the health, growth, and general physical development of the young soldier by improving his environment, and by the exercise of special care in the selection of the kind and quality of his food, and in its preparation and preservation.

Should the Government decide to institute the larger inquiry into the National Health. or the more limited one dealing chiefly or solely with the class supplying the majority of recruits, the Committee would suggest that, in addition to military men, the Commission should contain employers of labour, representatives of the working classes, persons who have specially studied matters relating to public health, and members of the medical profession. With respect to the last-named, the Council would be pleased, in conjunction with the Royal College of Physicians, to nominate representatives specially acquainted with the subject-matter of the inquiry.

JOHN TWEEDY,
President.

The Lord President of The Council has appointed the following to be a Committee to make a preliminary inquiry into the alleged physical deterioration of certain classes of the community:

Mr. Almeric FitzRoy, C.V.O., Clerk to the Privy Council; Colonel G. M. Fox, C.B., formerly head of The Army Gymnastic School; Mr. J. G. Legge, Chief Inspector of Reformatory and Industrial Schools; Mr. H. M. Lindsell, Principal Assistant Secretary to the Board of Education; Colonel George T. Onslow, C.B., Inspector of Marine Recruiting; Mr. John Struthers, C.B., Assistant Secretary to the Scotch Education Department, and Dr. J. F. W. Tatham, of the General Register Office, Somerset House.

PUBLIC HEALTH MEDICAL APPOINTMENTS.

ARNOLD, FRANK ARTHUR, M.B. Lond., D.P.H., Assistant Medical Officer, Transvaal, Pretoria.

BOURKE, JAMES JOSEPH FITZGERALD, L.R.C.P.I., Medical Officer of Health for Hughenden, Queensland.

FLINN, IGNATIUS JOSEPH, M.D. Irel., Medical Officer of Health for Bunbury, West Australia.

HARBISON, WILLIAM HENRY, L.R.C.P. Edin., Medical Officer of Health, for Wallaroo, South Australia.

HOLMES, HENRY GEORGE, M.B., Medical Officer of Health, for Warialda, New South Wales.

HOPE, EDWARD CULBERTSON, M.R.C.S., Medical Officer of Health for Winton, Queensland.

KANE, ROBERT ENGLISH, L.R.C.P. Edin., Medical Officer of Health for Taroon, Queensland.

LLEWELLYN, REES FRANK, M.D., Medical Officer of Health for Braidwood, New South Wales.

LONG, SYDNEY HERBERT, M.D. Cantab., Medical Officer of Health for Cromer.

MCCALL, HENRY JOHN, President of the Central Board of Health, Tasmania.

PEARSE, THOMAS FREDERICK, M.D., F.R.C.S. Eng., D.P.H. Camb., M.R.C.P., Lecturer on Hygiene, Medical College, Calcutta.

SCURFIELD, HAROLD, M.D. Edin., Medical Officer of Health for Sheffield.

DIPLOMAS IN PUBLIC HEALTH.

University of Durham.—Bachelor in Hygiene (B.Hy.): Wilfrid Ernest Alderson, M.D. Durh.; Laurence McNabb, M.B., D.P.H. Durh. Diploma in Public Health: Wilfred Ernest Alderson, M.D. Durh.; William George Barras, M.D., L.S.Sc. Durh.; William Edwin Peacock, M.D. Durh.; David Young, M.B. Edin.

BOOKS, JOURNALS, REPORTS, ETC., RECEIVED.

The following books, journals, reports, etc., have been received:

The Lancet; The British Medical Journal; The Sanitary Record; The Surveyor; The Medical Times and Hospital Gazette; The Medical Review; The Pharmaceutical Journal; The Councillor and Guardian; Albany Medical Annals; The Glasgow Medical Journal; Public Health; The Journal of the Society of Chemical Industry; Egésyég; La Presse Médicale; La Salute Pubblica; The Journal of Tropical Medicine; The Caledonian Medical Journal; The Public Health Engineer; The Journal of the United Service Institution; The Journal of the Association of Military Surgeons of the United States; Tuberculosis; Journal of the Royal Army Medical Corps.

First Aid (Collie and Wightman).

West Riding County Council Annual Report; Annual Report Berkshire Combined Districts; Report on Small-pox in Eccles; Report County Borough of Huddersfield, October 3, 1903; Report on Sanitary Condition of Horbury Urban District; Report Medical Officer of Health for Natal.

Appendix to Professor Simpson's Notes on Plague; Report on Sanitary Administration of the Punjab; Notes on Vaccination in the Punjab.

Letters, Notes, Queries, etc.

Communications respecting Editorial matters should be addressed to "THE EDITOR, JOURNAL OF STATE MEDICINE, 19, Bloomsbury Square, W.C." *Those concerning business matters, non-delivery of the* JOURNAL, *etc., should be addressed to* "THE SECRETARY, The Royal Institute of Public Health, 19, Bloomsbury Square, W.C."

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Communications which have been sent to other journals cannot be received.

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Telephone number of The Royal Institute of Public Health, No. 1614 Central.

The Journal of State Medicine.

THE OFFICIAL ORGAN OF
THE ROYAL INSTITUTE OF PUBLIC HEALTH.

VOL. XI.] DECEMBER, 1903. [No. 12.

THE HARBEN LECTURES FOR 1903.

Delivered in King's College, University of London.

BY

FERDINAND HUEPPE, M.D.,
Professor of Hygiene in the German University of Prague.

LECTURE II.

HYGIENE AND SERUM RESEARCHES.

MR. PRESIDENT, LADIES AND GENTLEMEN,—In my first lecture I endeavoured to show you that, if we consider the causes of diseases from a natural and energetical point of view, we must conclude that the real origin of the specificity and irregularity of an infectious disease lies in the inherited or acquired predisposition. The disease stimulus represented by pathogenic bacteria cannot cause any result which was not previously present in the body as a predisposition. The specificity of the pathogenic bacteria has only the meaning of a specific stimulus, which stimulus fits in with the predisposition as a key fits a lock. If this conception be the real explanation of the facts, then the progress of scientific knowledge must lead to the same result as explained in my first lecture, in spite of the fact that for a time one may expect a different result. I am glad to be able to state also that the most enthusiastic followers of the opposite opinion —according to which opinion only the specificity of the pathogenic bacteria influences the quality of the effect—come more and more to my conception. It will suffice to mention here the names of Professors Behring and R. Pfeiffer. For a time,

contrary to my conception, the strong specificity of the immunity seemed to be only dependent on the specific bacteria. This conclusion was, however, incorrect.

At the beginning of these studies it was impossible to experiment with the predisposition, but it was possible to experiment with the immunity by inoculating animals with living or dead bacteria, or with their metabolic products. On this question Metschnikoff had a theory which greatly pleased the pathologists, because the basis of the cellular pathology was therein included. I will only remind you of its favourable acceptance by Lord Lister. Metschnikoff supposed that the leucocytes—*i.e.*, the wandering white blood cells—have or acquire the faculty to engulf, kill, and digest the pathogenic bacteria. According to this view, predisposition is something quite negative—namely, the incapability of the so-called phagocytosis.

The experiments seemed frequently to favour this theory, and Metschnikoff was often able to prove his adversaries to be in the wrong. He arrived at the conclusion that the cells could not be neglected, whereas some of his opponents, viz., Buchner and Behring, were for a time almost of the opinion that the humours of the body were of more importance. This last opinion arose from the fact that, according to Traube and Geschneider (1864), saprophytic bacteria, when injected into bloodvessels, will almost immediately disappear, and also from the observation that blood without blood cells can destroy pathogenic bacteria in the body, and out of the body in our test-tubes. These experiments have been made by Grohmann, Fodor, Flügge, Nuttall, and Buchner. Buchner called this destroying, active, proteid-like body in the blood "alexin."

Hankin brought together these different views, demonstrating that the alexins were probably produced by the leucocytes. Even Metschnikoff accepted this suggestion, which was extended through the observation that alexins could also be produced by other cells. Through these experiments the following facts were established:

1. Blood without cells can destroy pathogenic bacteria.

2. This faculty of the blood can become apparent or augmented through the specific immunization.

3. The origin of the active substance of the blood lies in the cells of the body. With these facts the conspicuous active capability of the blood serum and tissue fluids agreed with the older experiments on digestive enzymes, which are also produced by cells and are also capable of being active in and out of the body. But this analogy does not suffice to recognise exactly such complicated processes. Direct experiments must also be made.

For this purpose one must distinguish between two groups of infectious diseases, which groups are connected with one another through transition forms. One of these groups—for instance, cholera and typhoid fever—is characterized in so far as the body with inherited or acquired immunity has the faculty of protecting itself against the growth of invading bacteria, and also to destroy bacteria; we call this destroying power "bactericidy." In the other group—for instance, tetanus and diphtheria—the body possesses or acquires the faculty to paralyze the poison of the bacteria; this paralyzing power we call "antitoxic" power.

In some cases of acquired or inherited immunity the destroying power can be more important; in other cases the paralyzing power is prevalent. For example, if we inoculate pure tetanus cultures we appear only to receive poison and the paralyzing of the same. If we inoculate some cholera cultures we appear only to receive bactericidy. But we must not forget that if we inoculate cultures and their fluids we have in every case the destroying and the paralyzing power in various quantities near one another.

If true immunity be obtained with metabolic products, bodies must be present in these products which act unlike the poisons. Immunity in the strongest sense is the power of destroying bacteria, and through this power it also prevents the appearance of bacterial poisons. But experimentally we can study quite separately the effect of the bacteria without poison, and of the bacterial poison without bacteria. When inoculated alone, the bacteria as stimulus produce the destroying power; for this reason we call this active substance of the bacterial body "immunism." If inoculated alone, the bacterial poison as a metabolic product of the cultures, produces as stimulus the paralyzing power; this

poison is called "toxin." As a result of the inoculation of toxin, the body comports itself towards this poison, and becomes accustomed to increasing quantities of the specific poison, and in the blood we find antidotes of the poison—the so-called antitoxins. The antitoxins in the blood serum can be used therapeutically.

In 1895 I already recognised that (1) antitoxins do not cure because they immunize, but this is not so—on the contrary, they cure, though they do not immunize; (2) that the formation of antitoxins is not the cause of the habituation to or tolerance of poison; (3) the formation of antitoxin is certainly nothing but an accessory of or concomitant to immunity and habituation to poison; (4) the essential of the habituation to poison originates from the fact that toxins act upon susceptible cell protoplasm as stimulus.

We will understand this better from an explanation given by Ehrlich and completed by myself. A molecule of poison with two active atomic groups $(h + tx)$ joins itself with the molecule of the cell protoplasm, with two active atomic groups $(r + tph)$ through corresponding atomic groups; these groups of the molecules of the poison are named haptophores (h), and that of the protoplasm receptor (r). If these two groups are united with one another $(h = r)$, the other atomic group of the toxin, called toxophor (tx), will become free, and acts as poison on the protoplasm if this has a corresponding atomic group, the toxophil (tph)—viz., $tx = tph$, or $(tx + h) = (r + tph.)$

Poisoning is also possible if (1) a cell has receptors and toxophil groups; (2) if, when a receptor does not exist or is destroyed, the toxophil of the cell lies free, and therefore can join itself directly with the toxophor of the toxin.

An animal can also have a natural resistance against poison (1) if its cells have no receptors, and therefore cannot unite with them; (2) if the toxin can unite, but the cells fail to have toxophils. For example, this is the case with the alligator: the tetanus poison can unite with the cells and produce antitoxin, but the alligator does not become poisoned.

I have demonstrated that in the active proteids of the protoplasm potential and kinetic energy is contained. The kinetic

energy is connected with labile atomic groups. If, for example, the activity of the protoplasm is caused by the presence of aldehyde groups (CHO), and the activity of the toxin by cyanogen groups (CN), both these groups can have a reaction if brought together, both groups combine themselves to a passive molecule. Therefore the kinetic energy disappears; the protoplasm is not active, it is injured often to necrobiosis or absolute death (necrosis), from reparable to irreparable wounds. This is my view of the activity of proteids and proteid-like poisons, as the toxins are regarded.

Toxins acting upon cells form products of this reaction. These products, which contain the haptophor and receptor ($h+r$), enter the blood, circulate, and are then got rid of by excretion, by oxidation, chemical combination, and so on. As long as these bodies circulate in the blood they can unite with toxin, because they have the same haptophor and receptor, and for that reason the toxophor of the toxin cannot unite with the protected toxophil group of the protoplasm. Therefore proteids with these groups ($h=r$) as free molecules in the blood are the antitoxins.

For the resistance of, and the habituation to, poison, it is an accessory or secondary question whether the toxin is caught by the antitoxin. The habituation depends only on the specific cells of the body being stimulated by the toxical impulse. If this is correct, then the production of such antitoxins must happen without any previous action of toxins whatever, and, on the contrary tolerance, to poison must be possible if no antitoxin is present in the blood. It is important to note that all these possibilities are realized by distinct facts, which I will not mention in detail.

It has been proved by all experiments that the specific state of the cells of the body is decisive for natural resistance against poison and for the experimental habituation to poison, also in those cases in which specific resistance is present against, or formed by, the stimulus of specific bacterial toxins. The specific bacterial toxins as stimuli can produce nothing in the body which is not already preformed in the constitution of the specific cell protoplasm.

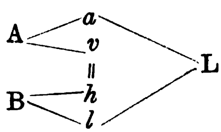
Herewith is in principle admitted that natural resistance, artificial habituation, and susceptibility to poisons are not contraries, but correlates. We can also apply the same fundamental facts to the more complicated phenomena of the bactericidy.

Inoculating an animal with specific bacterial cultures, Emmerich was the first to recognise the fact that specific bactericidal serum was formed. According to R. Pfeiffer, (1) if we inject cholera bacteria into the peritoneum of immunized guinea-pigs, or (2) if we inject into the peritoneum of normal guinea-pigs cholera bacteria suspended in bouillon to which some cholera serum has been added, the bacteria show a remarkable alteration. Metschnikoff was then able to bring about the same result in a test-tube by adding leucocytes or peritoneal fluid of a normal animal to a bouillion culture of cholera bacteria mixed with cholera serum. Then Bordet demonstrated that the addition of the serum of any animal taken at random produces the same effect, and he also showed that in a fresh state the serum of an animal immunized against cholera can do all this alone.

Through these experiments Bordet came to a conception, which became the basis of all further researches. According to Bordet, two substances are necessary to immunize. The one (A) is only formed by the specific immunization—that is, by the stimulus of pathogenic bacteria. This substance is relatively stable. It does not directly harm the bacteria, but it prepares the bacteria as "substancius sensibilisatrice" for the working or action of the second substance. This other substance (B) is always present in normal blood; it is very changeable, and loses its activity if it remains several days exposed to the open air, or if it is heated for a short time to 55° C. This substance is identical with Buchner's alexin. According to this idea, Bordet supposes that the specific bactericidy is caused by the common working of two simple substances (A and B).

These substances have received different names. The first substance (A) has been called "antikörper"—*i.e.*, antisubstance or antibody—by R. Pfeiffer; "immunkörper" (immune body), "zwischenkörper" (intermediary body), and "amboceptor," by Ehrlich and Morgenroth; "copula" by Müller; "substance

sensibilisatrice" by Bordet; "præparator" (preparer) by Gruber. The names given by Bordet and Gruber signify that this substance prepares the bacteria in a physiological manner; this partly agrees with the view of R. Pfeiffer, according to whom this substance is similar to an enzyme, and does not become used up in the process. The other names will express rather that the relations between the two substances are more of a chemical combination. The second substance (B) is called "alexin" (Buchner, Bordet), "complement" or "addiment" (Ehrlich and Morgenroth). The names used vary according to the conception. For example, the name "amboceptor" of Ehrlich is intended to signify that the substance is not so simple as it was taken to be by Bordet, but that it can combine itself on the one side with the cells of the body, or of bacteria through an atomic group (A), and on the other through another atomic group (v) with the second substance. This second substance (B) must be built up, as has already been said, with the toxin. The one atomic group of this substance (h) must unite with the corresponding group of the amboceptor ($v=h$). Only when that has happened can the second atomic group (1) become free and act, destroying or dissolving the bacteria to which it is united with the first atomic group (a) of the amboceptor ($a=l$), as dissolving body or lysin (L).



As the alexin or complement is a normal substance of the blood, for my aim it is not necessary for me to dwell more minutely on this last point. I will only mention that the researches in my laboratory in accordance with Ehrlich have proved that the non-specific bactericidy is not caused by alexins, as it was stated to be by Buchner, but that in all cases of bactericidy the two substances, alexin and amboceptor, must act together. My experiments prove, in accordance with Ehrlich, but in opposition to Buchner, Bordet, and Gruber, that there is not one alexin in the blood, but several, which may be distinguished from one another by combination and dissociation. In

this way we understand that every alexin does not complement every amboceptor.

Observing that out of the body in test-tubes bacteria can be destroyed, one believed that the alexin was the most important substance for bactericidy. Examining its occurence in the body, I was led to the opinion that the other substance, the amboceptor or immune body, is of more importance for inherited and acquired immunity. If this conception be right, the natural resistance, and the immunity of species and races—as a result of adaptation and selection—must be caused by the presence of immune bodies which are formed by the assimilation of nutriment.

In this sense Metschnikoff showed that the blood of quite normal men who never had the opportunity to be infected with cholera can destroy cholera bacteria, and Stein showed the same for typhoid fever.

From this we can understand that specific bacteria as stimulus are not necessary to get specific bactericidy.

The researches of the bactericidy and immunity were for several years interrupted by researches on hæmolysis—that is, the faculty of the blood serum of one species in dissolving the blood cells of another species. Buchner, Bordet, and Ehrlich made these experiments because the hæmolysis is clearer and not so complicated as the bactericidy; but it is a good analogy, and this analogy has greatly advanced our knowledge of the mechanism of these processes.

In spite of this, we were compelled to examine the bactericidy without regard to this analogy, especially because researches from my laboratory by Weleminsky, in accordance with Schattenfroh and Wassermann, have showed that the alexins in both processes, bactericidy and hæmolysis, must be different.

I will also add that the so-called agglutination which Gruber believed to be united with the bactericidy, being a cause of the same, is nothing but a concomitant of the bactericidy, as it was said to be by R. Pfeiffer, and proved especially through the experiments of Bail.

From the facts just mentioned, we are able to arrive at the following conceptions on the bactericidy : The immune body acts

as an amboceptor—that is to say, it joins itself on the one side to the bacteria by one atomic group (a), and on the other side with a group of the complement (h) by its corresponding group (v). Through this connection ($v=h$) the other group of the complement (l) becomes free, and acts as toxophor or zymotox on the bacteria, which it either destroys or dissolves.

The amboceptor can correspond to specific pathogenic bacteria because it is formed through this as specific stimulus, but it corresponds also with all other cells which have the same combining groups ($v=h$). For that reason it is not necessary that the amboceptor is brought into life by the stimulus of specific bacteria, but it can also be brought into life by the assimilation of food. Specific bacteria can only cause the formation of the amboceptor if the cells of the body have a corresponding atomic group (v)--that is to say that the specificity of the cells of the body decides the natural immunity and the artificial and experimental immunization.

Specific bacteria as stimulus can produce nothing from the cells of the body which was not already therein as a predisposition. The specific faculties of the cells are the real internal cause of the immunity, and the specific bacteria only act as the external stimulus in these energetical relations.

If we have the intention to form and augment the amboceptors experimentally, we must use as stimulus the specific bacteria, but this is only the augmentation of the preformed faculties. For the susceptibility of the body to specific disease these cell faculties are preformed, but not in sufficient quantity. In the natural immunity of the species and races these faculties are sufficiently developed by adaptation and selection. From this we see that susceptibility to a specific disease, artificial immunization, and natural immunity against it, are only relative ideas.

Naturally, the intensity of the stimulus must have some value, as it was demonstrated by R. Pfeiffer that virulent specific germs have greater avidity to the immune bodies than less virulent or non-virulent germs; but also non-virulent germs can immunize, as was shown for the first time by Wood and myself.

If bacteria are united with amboceptors they must be de-

stroyed or dissolved. Bacteria must, therefore, even then be destroyed, as it was demonstrated by Pfeiffer, Friedberger, and Radziewsky, when their number is so great that at last they come out victorious and infect the body. Infection is, therefore, a struggle between two kinds of cells, and the result of this struggle depends on the qualities and quantities of both groups of cells.

Pfeiffer and Marx have proved the important fact that the immune body which acts against cholera bacteria is formed in the spleen, in the marrow of the bones, and in lymphatic glands. Pfeiffer proved that one dose of alcohol and several small blood-lettings will augment the amboceptors by acting as stimulus. The immune bodies can be dialyzed and heated, and in this way their relationship to the cell proteids proved.

In all these cases the form of the bactericidy is similar to that of the test-tubes. Bactericidy is present in both cases, and it seems to be the cause of the immunity.

The relations of the anthrax bacillus were quite different. The serum of the chicken, which is quite immune against anthrax, and of the dog, which is very little susceptible to anthrax, is not bactericidal. The serum of the rabbit, which is very susceptible to anthrax, is bactericidal, but the serum of sheep and cattle, which are also susceptible, is not bactericidal. There is no parallelism between the serum bactericidy in test-tubes and the resistance of the animals, between bactericidy on the one side and predisposition and immunity on the other.

Has the bactericidy, therefore, nothing to do with the immunity, as was said by Lubarsch? Not at all. The right answer to this question appeared to me of such importance that we made experiments in my laboratory for several years, and Bail and Pettersson received at the end very interesting results. In test-tubes the non-bactericidal serum of the chicken, dog, sheep and cattle was made bactericidal through the complement of rabbits, the serum of dogs, also by leucocytes of dogs. The organism of the dog has both substances for bactericidy, but in the serum of the dog they are not present in such a manner as to be able to act in test-tubes. It was seen in some experiments that the differ

ences between the bactericidy in test-tubes and in animals are not so great, because not only the serum but also the blood plasm can cause the bactericidy, and the defibrinated blood of dogs, of which the serum was inactive in the test-tubes, was from time to time bactericidal. We find bactericidy very much developed in the organs of the dog, and still more in those of the chicken. Not so in the organs of rabbits, where the bactericidal power of the serum is perfectly paralyzed through the power of the organs, and we see nothing of this conspicuous bactericidy in the test-tubes. If we immunize rabbits against anthrax, then the organs of this animal destroy anthrax bacilli like the organs of the chicken or the dog, and the serum of these rabbits is also bactericidal in the test-tubes. We still further found that the destroying power of an immunized rabbit is nothing else than the augmentation of cell faculties which are not sufficiently developed to protect the rabbit against anthrax. The rudiments of the destroying faculty are present in different quantities in the organs of all rabbits, and therefore rabbits can be immunized against anthrax. We find differences in the destroying power: the destroying power of the serum in the test-tubes is very rapid, whereas it is more gradual in the organs.

Now we understand that every immunity can be done away with through augmentation of the virulence and the quantity of the specific bacteria. There is, of course, a point at which no natural resistance and no artificial immunization suffice. If the bacteria are only slightly virulent and not numerous, quite a small resistance suffices to protect the body against infection.

Our experiments proved that the specificity of the cells of the body is of decisive importance to the specificity of the immunity. The chief result of immunization or immunity—that is, the acquired or inherited resistance against anthrax—was the same, but there were great differences in the particularities of the different species of animals. The serum of the rat, rabbit, and horse—quite different species—is very similar in test-tubes, but these animals and their organs act very differently against anthrax bacilli. The chicken, dog, sheep and cattle have very great differences of natural resistance against anthrax, and their organs act in quite

a different manner against it, although their serum in test-tubes is almost the same.

The constitution of the immune bodies, as that of antitoxins, shows us through combination and dissociation differences according to the species of the animals, even if these substances are reproduced by the stimulus of the same pathogenic bacteria. The protoplasm or active proteid may vary greatly according to species, but if it has a corresponding atomic group it can be stimulated by the same pathogenic bacteria and form specific immune bodies.

In agreement with this a very interesting observation has been made by Cartwright Wood. When he cultivated bacteria of diphtheria in solutions consisting for the most part of the serum of a certain animal, he was only able to produce the greatest antitoxic effect in animals of the same species; for example, in the serum of horses by cultures in horses' serum, but not by cultures in the serum of human beings, cattle, goats or sheep. On the other hand, toxin from cultures in horses' serum was not able to produce a good antitoxin in the blood of goats.

I am very glad that Ehrlich, after studying hæmolysis, came to conceptions of bactericidy which agree with my former views. Behring and Pfeiffer, who at first opposed my conceptions, accepted Ehrlich's views—that is to say, they have given up their opposition to my conceptions. I can prove that Ehrlich came to the same conception of immunity as I expressed already in 1895, while all others had then a contrary opinion. I said then, word for word ("Naturwissenschaftliche Einführung in die Bakteriologie," 1896, p. 195; English translation by Jordan, "The Principles of Bacteriology," 1899, p. 340): "In spite of the proof that elements of 'specific' microbes are concerned in the production of the antitoxins or germicidal substances found in the blood of animals specifically immunized or made tolerant of poison, it is very probable that these 'specific' bacterial substances merely furnish the necessary stimulus. The peculiar antitoxic and bactericidal action observed in such cases is due to the qualities of the substances which are formed in the serum in larger quantities in those animals made immune or tolerant of poison; normal animals already contain the same 'specific'

substances, but in smaller quantities. The property of specificity, which is seemingly a newly-acquired quality, may not unreasonably be conceived of as a quantitative variation and as dependent upon the bringing into action of normal forces by appropriate stimuli."

But it is not only this conception. We can now recognise better what the predisposition is. It is no longer a negative idea in opposition to the positive idea of immunity. Predisposition is no longer the antithesis of immunization, but it is the real correlate of it, as it was named by Martius. Immunization is only the augmentation of faculties which are preformed as predisposition. Predisposition is something positive, but it does not suffice to protect the body against infection.

Predisposition, immunization, and natural immunity are different manifestations of the same faculties of the specific cells of the body. These results of the researches on the antitoxic and bactericidal power of the body are a striking confirmation of the energetical conception of the causes of disease, as it was proposed by myself and expressed in my first lecture.

With this energetical conception there is no longer opposition between bacteriology and cellular pathology, and medical science —quite free from all ontology and the entities of diseased cells and pathogenic bacteria—can be a real natural science.

You will, perhaps, ask me, gentlemen, if these researches on antitoxin and immunity have any practical result for public health?

The chief result was the so-called specific serum therapy, but therapeutics are only to be used by practical physicians. We have seen that the protective substances of the blood can be produced by assimilation, and therefore we can expect to produce and augment the substances through nutrition, physical education, and all other methods of individual hygiene.

Then it will no longer be necessary to inoculate into us a horse's serum with protective substances, because we by this training—speaking in plain words—will acquire the nature or resisting power of a horse.

Individual hygiene, as a branch of the positive hygiene, must become more and more a part of the public health, if we work to prevent the degeneration of the human race.

SHELLFISH AND THEIR RELATION TO DISEASE, MORE PARTICULARLY TYPHOID FEVER.

BY

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THE term "shellfish" in this paper includes not only oysters, which for some years have been recognised as dangerous, but all other forms of shellfish, more particularly cockles, mussels, clams, and whelks.

The real extent to which typhoid fever in this country generally is due to the consumption of sewage-polluted shellfish has been quite unrealized in the past.

Personally, I think that sewage-contaminated shellfish have played a very large, if not a leading, part in the general incidence of typhoid fever in this country. At any rate, as far as sea-coast towns are concerned, this, in my opinion, has been the main source of typhoid fever, though this is not even yet generally acknowledged. The object of this paper is to adduce evidence to uphold this strong belief and semi-dogmatic statement on my part.

Prior to sanitary administration becoming as advanced as it is at the present day, there can be little doubt that the chief incidence of typhoid fever was consequent upon polluted water and polluted milk supplies, which, again, were largely dependent upon imperfect ideas of cleanliness and equally imperfect methods of attaining cleanliness. Thanks to latter-day keen sanitary insight, these sources of typhoid fever have been, on the whole, satisfactorily attacked, with the result that the relative amount of typhoid has diminished considerably compared with fifty years ago. But for the last ten years there has been little or no further improvement in the general incidence of typhoid fever in this country; indeed, there has been a slight tendency to increase again, and this in spite of all sanitary efforts and circumstances. More care than ever before is being taken as regards our drinking-

water supplies, our milk supplies, our refuse and sewage disposal, and yet we seem for some years now to have struck the bottom of improvement as regards the incidence of typhoid fever. Why is this?

Since the Maidstone and Worthing epidemics there has been no very notable instance of an outbreak due to a polluted water-supply. Milk epidemics are apparently more rare than before, and yet we appear to have, not only an apparently irreducible minimum of typhoid fever of considerable degree, but actually a tendency to a slight increase in the prevalence of the disease.

Again I ask, Why is this? And in reply I say emphatically that, in my opinion, it is because we have not given the same attention to the maxims of cleanliness as regards *other* forms of food as we have given to preserving our water and milk supplies as much as possible from pollution. There can be no doubt that the mouth is the portal of infection in typhoid fever. In those localities which have a pure water-supply and efficient drainage and satisfactory sewage-disposal schemes, and yet have a greater incidence of typhoid fever than such localities should have, we must look to *other forms of food* as the *probable* vehicles of infection. When a town's water-supply is infected, we naturally have as a result a widespread epidemic. If different sections of a town have different supplies, it is that section which receives the polluted supply which suffers out of all proportion. When the germs of typhoid fever are conveyed by milk, the customers of a particular dairy, or of different dairies which receive their milk from a common source, are those that are chiefly attacked.

When, on the other hand, an outbreak occurs, and inquiries show that the water and the milk supplies are above suspicion, we have to look further afield for a common source.

Curiously enough in the past, endemicity of typhoid fever in districts with pure water and milk supplies has generally been attributed to soil-pollution through defective sewers or otherwise, even though such state of affairs may have been entirely or largely rectified for a considerable time previously. Yet, if viewed dispassionately, such a method of infection must play a small (indeed, almost inappreciable) part in towns with a

water-carriage system of sewage removal, and even in towns with leaky main sewers, provided that the drinking-water supply is incontaminable and the *house* drains in fair sanitary condition.

It is generally admitted that the oral cavity is the chief, if not (for all practical purposes) the only, portal for the entrance into the human body of the bacilli of typhoid fever. It is therefore most probable that the germs are almost invariably introduced by means of some article of diet or by polluted hands carried to the mouth after touching infected articles, whether of food, or raiment, or otherwise.

The only probable manner in which polluted soil could reasonably be expected to act as the vehicle of infection is by surface-soil becoming pulverized in dry weather, and thus capable of being blown by wind, or otherwise deposited on articles of food, or directly into the open mouth. Now, absence of moisture and direct sunlight are in themselves inimical to most bacteria, including the typhoid bacillus. Equally important is the antagonism of soil bacteria to intestinal bacteria, including the *Bacillus coli* and the *B. typhosus abdominalis.*

The elaborate experiments carried out by Martin and Houston [1] go far towards proving that the typhoid bacillus does not readily live in *surface*-soil, but is quickly killed out by ordinary soil bacteria, though Dr. Houston's further researches [2] into the bacterial quality of deep-soil water show a more lasting term of life for *B. coli* (and therefore presumably also for *B. typhosus abdominalis*) in the deeper layers of the soil, where there are fewer competitive bacteria, more moisture, less light, and more equable temperature, and other less antagonistic circumstances, than at the surface.

By the exhaustive researches of the above-named authorities the important fact appears to be almost established that *B. typhosus*, and also the most typical sewage bacteria, are quickly destroyed by surface-soils. Some might argue that the evidence is conflicting, but previous recorded experiments, which appear to point the other way, such as those of Grancher and Deschamps [3] in 1888, of Karlinski [4] in 1891, of Ufflemann [5] in 1893, of Dempster [6] in 1894, and of Robertson and Gibson [7] in 1898, are considerably

discounted by the fact that the cultural and other characters of the *B. typhosus* were not then sufficiently differentiated. Of more importance are the later experiments of Martin [8] and of Firth and Horrocks,[9] but as to the latter, they do not prove more than the possible viability of *B. typhosus* in fairly dry soil for a period of two or three months at the most; but as in the experiments carried out sods of earth were removed from the deeper layers, there was no opportunity for the inoculated bacilli to travel downwards, which, in the light of Dr. Houston's later experiments, seems to be the natural tendency on the part of the *B. typhosus*.

We may take it, then, as fairly accurate that typhoid bacilli do not exist for long in superficial soil, and that aerial infection from polluted soil must, therefore, be an unusual and improbable factor, though doubtless an occasional one. On the other hand, contaminated food-supplies are obvious and most probable sources of infection, particularly in the case of such foods as receive their infection through the medium of polluted water, such as shellfish, watercress, etc.

In giving evidence before the Royal Commission on Sewage Disposal on May 12 last, three principal questions were put to me. The first question was:

1. To what extent do you consider that enteric fever or other illness is caused by the consumption of sewage-contaminated shellfish? And I replied in substance as follows:

My researches into the causation of typhoid fever have led me to believe and declare that a very considerable proportion of the residuum of typhoid fever in this country, which persists in spite of all sanitary efforts and circumstances, is due to the consumption of infected shellfish from sewage-contaminated sources.

Out of 105 cases of typhoid fever notified in my district during 1902, I traced some connection with shellfish in at least 82 cases.

Besides these definite cases of typhoid fever, I know of several other persons who had diarrhœa after eating cockles from a creek into which a neighbouring town's sewage effluent discharges.

At a large and well-known seaside holiday resort about 30 per

cent. of the cases of typhoid fever which have occurred for some years past have been attributed to infected shellfish.

At another well-known seaside town typhoid fever was unduly prevalent in 1898 and 1899. These cases were attributed by the Medical Officer of Health to the consumption of mussels taken from the river, at the mouth of which the town is situated. The sale of these mussels in the town was stopped in 1900, and forthwith a marked diminution of typhoid fever was observed—to such a degree, indeed, that the largest number of notifications in any one month (September) in 1902 was no less than 30 per cent. *below the average monthly mean* for several preceding years.

In my own district, by repeatedly drawing attention to sewage-contaminated shellfish as a cause of typhoid fever, and thereby securing diminished consumption on the one hand and better methods of laying and cooking, and greater care in the procuring of shellfish from purer layings on the other hand, there has been this year (1903) a very decided diminution in the incidence of typhoid fever.

[The comparatively few cases which have occurred this year have nearly all been traceable to shellfish from doubtful or known polluted sources, or to watercress of unknown origin. The actual number of cases originating in the borough from January to September 16, 1903, among a residential population roughly estimated at 33,500 is fifteen, as compared with an average of forty-five cases for the same period during the preceding eight years among a population varying from 17,000 in 1895 to 31,500 in 1902.*]

N.B.—I wish to lay particular stress on the following facts. During 1902 I made special inquiries with the object of ascertaining as nearly as possible what proportion was borne to the entire residential population of Southend by the shellfish-eating section of the community, and the relative incidence of typhoid fever on these two sections of the population respectively and also on shellfish vendors as a class. I had inquiries made at 656 houses where cases of small-pox, scarlet fever, diphtheria, chicken-pox,

* Note made November 17, 1903. Of the cases of typhoid fever which have occurred in the borough during the last two months no less than 95 per cent. have been traced to the consumption of shellfish.

erysipelas, and typhoid fever had been notified in different parts of the borough. As a result, I ascertained that, with only two exceptions, the only shellfish-eaters in this inquiry were found *only in houses in which typhoid fever had occurred.* Another important fact in arriving at a relative estimate is this: Twenty out of twenty-two shellfish-shops in the borough shut up in October until the following season, because there is *so little local trade* in shell-fish. If 5 per cent. of the population ate shellfish there should be at least 1,500 persons in the borough who ate shellfish; but I gather from the two or three local shellfish merchants who keep open through the winter that their local custom is only with about fifty houses. Allowing as a liberal calculation that five persons in each house consume shellfish, we can estimate a probable number of only about 250 persons as shellfish-eaters out of a total population of about 33,500 residents. No doubt in the summer, when several shellfish stalls are open, a larger proportion of the residential population than 250 persons do eat shellfish, particularly "so-called" boiled cockles. But the shellfish merchants openly state that they have practically next to no *local* trade. An estimate of 1,600 persons, or 5 per cent. of the total population, cannot, therefore, be considered an under-estimation in face of the facts I have narrated, and probably is more than double the actual number. Still, to allow a wide margin which shall be beyond cavil, I base the following figures on 5 per cent. of the residential population as shellfish-eaters and 95 per cent. as non-shellfish-eaters. This will more than include such persons as eat shellfish in London during the day while living in the district at night. Working out for typhoid fever the standard terms of the ratios during 1902 per 1,000 persons in each section of the population of the district, I calculate these as follows:

For the entire population the attack-rate was 3·28 per 1,000 persons; for the shellfish-eating section, reckoned as 5 per cent. of the population, 51·25; for the remainder of the population, reckoned at 95 per cent. of the population, only 0·75.

The enormous preponderance on the shellfish-eating section is rendered very obvious by these figures *cæteris paribus.* Further,

it is evident that among 95 per cent. of the population who do not eat shellfish the incidence of typhoid fever is trifling, and therefore it is improbable that there is any special endemicity in the soil or situation of the town. It is easier still to estimate the number of shellfish vendors and their employés, and I calculate the attack-rate for these at no less than 160·0 per 1,000 persons. I think, then, that I have been able to adduce sufficient evidence to justify me in stating that I consider that typhoid fever is to a very large extent caused by the consumption of sewage-contaminated shellfish—in my own district, at any rate.

I may lay stress on another point. The seasonal incidence of typhoid fever in this country generally is at its lowest in May and June. This is concurrent with the *close* season for English and French oysters, and with the period when cockles and mussels are not in their prime and are less eaten than at other times. There can be no doubt that though foreign oysters are still in the market, and other shellfish are also eaten to some extent, that the *general consumption* of shellfish is less during these months than at other times of the year.

A point worth bearing in mind is that the chief seasonal incidence of typhoid fever in *London* occurs at a *later* date (November and December) than in the rest of the country generally (August, September, and October). I am inclined to attribute this in great measure to the fact that shellfish are more largely eaten in London during these later months, while in the rest of the country they are eaten chiefly in the early autumn.

2. A second pregnant question put to me by the Royal Commission was: What measures do you think should be adopted for preventing such danger to the public health?

I replied as follows: I suggest that legislation is required on the following lines. To provide for—

1. Penalties for cultivating or laying down shellfish in narrow creeks which receive either crude sewage or sewage effluents, unless such effluent has passed through land in addition to contact-beds, *and satisfies a bacterial standard of purification.* As a standard I would suggest that *B. coli* should not be present in larger numbers in effluents discharging within a mile of shellfish-layings than is

represented by five colonies of *B. coli* in cultures made from 100 c.c. of the effluent by the "filter-brushing method," and plated out in glucose-litmus agar or bile-salt agar with neutral red.

2. Penalties for the pollution of layings and cultivation-beds, which at the present time are pure.

3. Registration, efficient supervision, and efficient inspection of all shellfish layings.

4. Powers for sanitary authorities to prohibit the sale of such shellfish within their districts as in the opinion of the Medical Officer of Health were causing, or likely to cause, disease.

Have we any reason to think we can materially affect the present apparently irreducible minimum of typhoid fever in England? I reply that I think we can attain much nearer than at present to the ideal. How?

1. By avoiding the *touching* as well as the eating of all forms of shellfish except such as are beyond any suspicion of sewage-pollution. [If polluted shellfish are handled, even though not eaten, there is risk of the germ being carried to the mouth, as previously pointed out both by Dr. Newsholme and myself.]

2. By avoiding eating any uncooked vegetables which have been subjected to manurial pollution.

3. By the early removal to hospital of any case of typhoid fever which may occur. A large proportion of cases are secondary, consequent upon the nursing of patients by untrained relatives at home.

4. By careful and constant attention to effective sewerage schemes, and to frequent and effective disposal of all forms of trade and house refuse.

5. By all forms of cleanliness, which must apply particularly to our water, milk, and other food-supplies, and more particularly than previously to shellfish and watercress.

I have ventured on different occasions [10] to express my belief that, were the eating of shellfish abandoned in Southend, the incidence of typhoid fever in the district would lessen by fully one-half. I really understated the limits of my belief for the following reasons: 105 cases of typhoid fever were notified in Southend in 1902 among a residential population of, roughly,

32,000. Of these four were imported, and the history of these four showed that two had recently eaten oysters at Ipswich, one had eaten cockles in London, and the fourth was too ill to give any information. She had, however, come from Southampton, which recent history has shown was a place supplied with infected oysters from Emsworth about the time of this patient's infection. Among the 101 remaining cases, there was a history of the eating (or handling in one or two cases) of shellfish in 69 cases. In addition, there were certainly eight secondary cases arising from these, which were therefore indirectly attributable to shellfish. Of the remainder, five occurred at two semidetached houses on a farm, in one of which a few months previously a child who had eaten cockles had sickened with typhoid fever. It is now recognised that the bacilli of typhoid fever may be found in the urine of persons who have suffered from the disease long after recovery. I found no evidence of specifically polluted milk or water, but the cottages were provided with midden-privies under one roof, back to back, and with a common receptacle or cesspool for excreta beneath. At the time of the outbreak in these two cottages flies were numerous, and could easily fly from one cottage into the other, or from the privies into both. The source of infection, in my opinion, was probably the child, who had previously suffered from shellfish typhoid. If these five cases were undoubtedly secondary to the previous cockle case, the percentage of cases notified in Southend during 1902, which were connected with shellfish directly or indirectly, would be 82 per cent. of the total number. Even among the remaining 18 per cent. of the cases, some gave a doubtful history as to cockles; but I have thought it best to quite exclude these.

In five of the 101 cases, uncooked vegetables (such as watercress) were suspected as the probable vehicle, while only in two houses in which cases of typhoid fever occurred in 1902 were obvious sanitary defects found on the premises. There was no evidence of milk or drinking-water-borne infection at any time during the year.

My original researches into the causation of typhoid fever in Southend were embodied in a paper which I had the honour

of reading before the Congress of The Sanitary Institute, held at Manchester in September, 1902, which is published in the *Journal of the Sanitary Institute*, vol. xxiv., part iv.

At the close of the discussion on this paper, I submitted the following resolutions to the Section, and they were carried *nem. con.*:

"That it is the opinion of this Section that in the interests of the public health the laying down of all edible forms of shellfish in sewage-polluted creeks or other dangerous localities should be protected by law under heavy penalties.

"That all unpolluted layings, fattening beds, and storage ponds at present in use should be protected by law from pollution by sewage by any person or Sanitary Authority."

In January, 1903, the Public Health Committee of the London County Council passed an identically-worded suggestion to be laid before the Local Government Board.

It is, I think, important to point out that the lay mind of the ordinary individual (whether councillor or burgess) is under a misapprehension as to the real meaning of the so-called "purification" of sewage by bacterial or other treatment. It is therefore, perhaps, not a waste of time to say that when we speak of the purification of sewage, we really only mean, as a general rule, an *improvement* on the gross physical and chemical properties of crude sewage. The Thames Conservancy, for instance, has a standard of purification for sewage effluents before they may discharge into the river Thames. Now, it is possible for a sewage effluent to be sufficiently purified to pass this chemical standard, and yet still be exceedingly dangerous for man, owing to its still containing numerous disease-producing bacteria. The so-called "purification" of sewage is only one of degree, which hitherto has merely had to satisfy an arbitrary chemical standard. If, however, a bacterial count were made the standard, very few of the effluents which at present are passed as sufficiently "purified" could possibly pass as "pure."

There can be little doubt that the most satisfactory purification is attained by land treatment after bacterial treatment where a sufficiently large area of suitable land is available for the

purpose. From this view-point alone the Local Government Board is, in my opinion, justified in laying so much stress on the final land treatment of sewage effluents. But the difficulty in many instances of securing sufficient suitable land for the purpose is well known, and I do not propose in the present paper to enter into further detail in connection with this difficult subject. I only wish to emphasize the fact that a certain degree of physical and chemical purification of sewage does not necessarily imply that the sewage effluent is safe for shellfish layings as far as human consumption of them is concerned, though it may no longer be inimical to the life of the fish. The oyster or cockle in itself may appear none the worse for harbouring the typhoid bacillus or the colon bacillus, but it has certainly become a dangerous article of diet for man.

The oyster having been so much in evidence as a possible source of typhoid fever, I want to emphasize the fact that my experience in connection with shellfish and typhoid fever has made the part played by the oyster appear quite insignificant when compared with the part played by the cockle, which is so much more largely eaten by the less wealthy classes. I think this has probably been the case all along, but hitherto it has been believed that the cockle had all evil scalded out of it. Sir James Crichton Browne[11] acknowledges that I have dispelled that illusion. In other words, the method of cooking cockles has hitherto been incomplete and ineffectual from a bactericidal point of view. If the result of my crusade has only been to induce cockle vendors to cook their cockles more thoroughly (say for five clear minutes in actually boiling water all the time), I believe we shall see a great reduction in the incidence of typhoid fever. But we must not be content with this; we must insist that our shellfish are cultivated and laid in proper positions, far removed from any crude sewage or sewage effluent, in waters which will pass a fairly stringent bacterial test as to the absence of sewage organisms.

In another place[12] I have dealt fully with the reasons I have for thinking that in securing proper attention to our shellfish industries we shall achieve a very notable reduction in the

incidence of what I call the "residual" typhoid in this country. The present paper is merely a further contribution in connection with a matter which I feel is of very great moment.

Though as far as cockles are concerned the importance of this subject had not been recognised, except in one or two isolated instances, until I brought the matter forward at Manchester in September, 1902, yet as regards oysters, and occasionally mussels, for some years past the danger connected with shellfish has been fairly generally recognised among medical men. I think it will be of interest and advantage to give a brief, if necessarily incomplete, historical sketch of the investigations and suggestions which have hitherto been made in the matter of the connection between shellfish and disease.

As far as I can gather, Sir Charles Cameron, C.B., the distinguished Medical Officer of Health for Dublin, and Vice-President of this Section, who worthily received the Harben Gold Medal for his eminent services to the public health, was the first, so long ago as 1881, to suggest that the typhoid bacillus might perhaps sometimes mingle with the sewage matter which, under certain circumstances, oysters undoubtedly contain.

The late Sir Richard Thorne-Thorne, K.C.B., Principal Medical Officer to the Local Government Board, reporting on cholera in England in 1893, recorded his conviction that the distribution of shellfish from Grimsby and Cleethorpes "had been concerned in the diffusion of scattered cases of cholera over a somewhat wide area of England." Early in 1894 Dr. Newsholme, Medical Officer of Health for Brighton, recognised the causal relation between contaminated oysters and some eight cases of typhoid fever, and reported on further cases from time to time.

In November, 1894, Professor Conn, of Connecticut, U.S.A., clearly traced an outbreak of typhoid fever at the Wesleyan College, Connecticut, to contaminated oysters. The evidence adduced by Conn was both masterly and complete. Early in 1895 Sir William H. Broadbent, M.D., and Sir Peter Eade, M.D., published notes of cases of typhoid fever traceable to oysters eaten ten to fourteen days previously. Bacteriological investigations were made by Dr. Foote in connection with the Connecticut

outbreak, and by Dr. Klein on behalf of the Local Government Board. These experiments proved that not only did the oyster thrive in water containing sewage matter, but took up into its interior certain intestinal bacteria.

I have referred elsewhere[13] to Dr. Klein's more recent investigations, which led to the inference that typhoid and intestinal bacteria actually increased in numbers within the bodies of cockles laid in clean sea-water for three days after having been exposed to infected water for a short time.

In 1896 Sir Richard Thorne-Thorne issued a supplement to his Report as Medical Officer of the Local Government Board, embodying an exhaustive report by Dr. Bulstrode on the conditions under which edible shellfish are cultivated and stored at various places along the coasts of England and Wales. From this time onward medical attention generally was directed to the possibility of the causal relationship of oysters to typhoid fever, and from time to time reports of such cases were issued, while many more were never published, though no doubt recorded in private notes of cases.

Dr. Chantemesse recorded fourteen cases of typhoid fever in six houses in June, 1896, the common factor being that all fourteen persons had partaken of sewage contaminated oysters.

In 1897 a small outbreak of typhoid fever at Blackpool was traced to mussels, and a considerable amount of typhoid in Yarmouth in 1899 was traced to mussels laid in the Yare. In 1899 eighty-five cases of typhoid fever at Exeter were traced to *raw* cockles. At North Lynn in 1900 ten cases of typhoid fever occurred among thirty persons who had eaten clams from a spot about three miles below the discharge of the King's Lynn sewage. In Southwark in 1900 an outbreak occurred between August 16 and October 10 which was attributed by Dr. Hamer, after careful investigation, to *fried fish** from one particular shop. In 1899 Drs. Thresh and Walter suspected cockles as the source of an outbreak of typhoid at Shoeburyness, and Lieutenant-Colonel A. M. Davies, R.A.M.C., who investigated the causes of typhoid

* I have had reason myself to suspect fried fish as the source of origin of more than one case.

fever among the military at Shoeburyness, attributed some six cases "with the greatest probability short of certainty" to eating cockles.

In 1902, by a series of cases in Southend, I have been able to show beyond all reasonable doubt that "cooked" cockles, as hitherto prepared for the market, are capable of conveying the infection of typhoid fever, and my conclusions have been amply confirmed by my later experience.

The causal relationship of all kinds of polluted edible shellfish to typhoid fever having thus been demonstrated again and again, it remains to inquire what action has hitherto been taken to remedy the matter.

To the Brighton Sanitary Authority, under the guidance of their Medical Officer of Health, Dr. Newsholme, belongs the credit of having first made representations to the Local Government Board, which induced the Board to appoint a medical inspector, Dr. Bulstrode, to make a detailed inquiry into "Oyster Culture in Relation to Disease." Again, in 1896, Brighton attempted to obtain Parliamentary powers authorizing the Sanitary Authority to prohibit the sale within their district of shellfish suspected to be the cause of infectious disease. In 1899 the Government introduced an Oysters Bill to lay upon local authorities the duties of inspecting oyster-laying within their boundaries and prohibiting the use of contaminated oysters from these layings. But even this moderate measure did not become law. The Brighton Bill was far preferable. In 1899 the Southend Corporation promoted a Bill which contained a clause relating to shellfish on the foreshore, but the intended Bill was rejected at the statutory meeting of owners and ratepayers. A new Bill with further clauses is again under consideration.

At Manchester, in September, 1902, I suggested legislation on certain lines, as recorded in the *Journal of the Sanitary Institute*. These provided for:

1. Penalties for laying down edible shellfish in polluted streams.

2. Penalties for pollution of layings and cultivation beds at present pure.

3. Registration, efficient supervision, and inspection of all layings.

4. Powers for Sanitary Authorities to prohibit the sale of such shellfish within their districts as, in the opinion of the Medical Officer of Health, were causing, or *likely to cause*, disease.

5. Clauses to deal with imported shellfish from continental sources.

There can be no possibility of doubt that such legislation is urgently needed, and as the Corporation of the City of London and the London County Council have since approached the Local Government Board on the subject, there is greater hope of success in this direction than when action was limited to one or two provincial Sanitary Authorities. I am strongly of opinion that every Sanitary Authority concerned should appoint a deputation to wait on the President of the Local Government Board towards securing legislation on the subject applicable to all shellfish layings. Short of this, individual Sanitary Authorities most concerned should seek Parliamentary powers to prohibit the sale within their districts of shellfish known or suspected to be the cause of disease.

During the first six months of 1903 my own district has been more free of typhoid than during the corresponding period of any previous year of which I can find any record. During this period in 1903 there were only five cases of typhoid fever which originated in the borough. Of these, one was attributed to infected watercress, another was secondary to a previous shellfish case, while the remaining three had partaken of oysters within the incubation period. One of these three cases had eaten oysters brought from London.

I communicated this fact, as well as the oyster merchant's address, to the Medical Officer of Health for the City of London, who promptly secured samples of the oysters and had them bacteriologically examined. The examination results showed gross sewage contamination of the oysters, and, in consequence, several hundreds of these oysters were seized and condemned.

I attribute the lessened incidence of typhoid fever in my own district almost entirely to the prominent and repeated publicity

which I have given to the connection I have traced between polluted shellfish and typhoid fever, and to the greater precautions which have been taken in consequence by the majority of the local shellfish vendors. The better educated and more discreet members of this fraternity, having satisfied themselves that my contentions were correct, clubbed together, arranged to get their cockles from a purer source than Leigh, and erected a large boiling-shed, which contains a large copper of *one hundred and forty gallons*, which therefore contains enough water to remain boiling when the cockles are plunged into the copper. The coppers hitherto in use at Leigh were of a capacity of only four to six gallons, and ceased to boil, even if boiling, when the cockles were introduced. The cockles are now, in the large copper of 140 gallons, *kept boiling for three and a half to five minutes*, instead of, as formerly, removed from the copper directly the water again came to the boil.

Note added September 17, 1903.

I am glad to say that, up to the present time, since these precautions have been adopted, I have not had a single case of typhoid traceable to cockles from *this* source. But a few of the local shellfish vendors still obtain their cockles from Leigh, though they state they are now boiled for three and a half minutes. In consequence of the longer boiling these Leigh cockles are doubtless less dangerous than formerly, but that all the cockles fail to be completely sterilized is evidenced by the fact that I have been able to trace four cases of typhoid this summer to cockles purchased in or obtained from Leigh.

Knowing that the Worshipful Company of Fishmongers had refused to allow cockles from Leigh to appear in the London market since the beginning of this year (1903), I inquired of Mr. Shirley Murphy, Medical Officer to the London County Council, whether there had been any reduction in the incidence of typhoid fever in London. He kindly informed me that during the six months ending June 30, 1903, the typhoid incidence had been very materially less than during any previous year on

record. I venture to think that this lessened incidence will continue, because hitherto a very large number of cockles from Leigh have been imported into London. I believe this lessened incidence is the outcome of publicity and of discussing questions such as these at congresses. The public gradually become more careful, and their representatives will in time insist that their food-supplies shall all of them be above suspicion of gross sewage contamination. On the other hand, the shellfish merchants, in their own interests, are compelled to give the matter the attention which its gravity demands, and to cultivate and lay their shellfish in improved positions; while schemes for sewage disposal or purification will in future receive more careful consideration as to the part they may play in the pollution of recognised shellfish layings. Some improvement in all these directions, I think, has begun, but the crusade must be waged with unabated vigour until Parliament steps in with legislative measures of an adequate nature, when the evidence of the Royal Commission on sewage disposal is laid before the nation.

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WATER-SUPPLY.

BY

JOSEPH PARRY, M.Inst.C.E.,

Chief Engineer of the Liverpool Corporation Waterworks.

The subject of water-supply is so comprehensive that it is obvious I can only select one or two of its many aspects for consideration within the limits of time at my disposal.

Let me first of all say a few words about Liverpool. The Corporation of this city have always acted in reference to the important matter of the water-supply in a very liberal and far-seeing spirit: first, in providing, as far back as the year 1842, when the works were still in the hands of two private companies, a separate supply with special mains throughout the business parts of the town, for extinguishing fires and for public sanitary purposes. Then in 1847, in acquiring by purchase the undertakings of the companies, and at the same time obtaining powers to construct large gravitation works at Rivington. Again, in 1880, when those works became inadequate to satisfy the growing wants of the district, in adopting and carrying out a still larger scheme for bringing to Liverpool the waters of the river Vyrnwy, in North Wales, a distance of sixty-eight miles.

True to their policy of making ample provision for the future, the Corporation have now commenced to lay a second line of pipes from Lake Vyrnwy, to utilize still further the yield of that gathering-ground. This new line of pipes will cost about a million of money, and when completed will place the Corporation in possession of sufficient water at their own door to give thirty gallons per head per day to 1,500,000 people.

Now, what is broadly and generally the position of the country to-day with regard to this vital question of water-supply? The principle is now almost universally accepted that the provision of water for any town or district should be undertaken by the Local Authority, and should not be left to private enterprise or undertaken for private gain. The Local Authorities, upon whom this duty devolves, find themselves called upon to satisfy a much

higher standard, both as to quality and quantity, than was accepted a few years ago.

Recent scientific progress, and particularly the progress made in the science of bacteriology, has revealed the existence of impurities and dangers to health which formerly were only suspected, and which eluded the tests of the chemist. This has led to a demand for water free from such impurities, and not exposed to contact with pathogenic organisms. At the same time, while this demand for a higher degree of purity is being made, the medical experts who make a special study of public health are asking for a much more liberal use of water than has hitherto been considered necessary. Their cry is for pure water, and more of it. In trying to meet this demand we realize how limited are the available resources of the country, and the difficulty of finding new sources capable of yielding good and wholesome water in sufficient quantity presses with especial severity upon small manufacturing towns and rural districts.

These difficulties are of a serious character, and they will inevitably become still more serious, not only with the growth of population and trade, but also as many of the present sources come to be condemned and rejected. This leads me to one conclusion, which appears to be self-evident, but which requires a practical application. It is that all local authorities, and all supporters of health congresses and sanitary associations of every kind, should co-operate to protect and preserve the natural water resources of the country, and to distribute those resources as freely and cheaply as the conditions will permit.

To apply this principle in a practical form, I invite you to consider two of the many ways in which the action or inaction of Local Authorities may be prejudicial. One of these is of minor importance relatively, but nevertheless worthy of consideration. I refer to the rating of waterworks. Both the law and practice relating to the fixing of assessments are notoriously defective and unsatisfactory, and many attempts at reform have been made, though so far without success. The recommendations of the Royal Commission on local taxation of 1901 seem destined to share the same fate as other efforts in the same direction. The

reforms most urgently needed are—the adoption of one uniform method of rating and the simplification of the machinery for determining the amounts. It is said that no Bill affecting the rating of waterworks would have any chance of passing through the House of Commons if it would have the effect of reducing the assessments because it would be, opposed by a great number of Local Authorities interested in maintaining high rateable values. For this reason I am anxious to appeal to the representatives of Local Authorities to look at the subject from the point of view of public health, and to co-operate in removing this and all other obstacles that may tend to interfere with the adoption of new water schemes. Let me illustrate the significance of this by stating that last year the amount paid by Liverpool in local rates and taxes upon their waterworks was £26,827. Of this about £19,180 was in respect of mains laid underground, the existence of which could not appreciably affect the rateable value of the surface.

Twenty years ago, in 1882, the total amount paid was £12,850, or less than one-half the present contribution.

In 1862—forty years ago—the amount contributed to local rates by the Liverpool Waterworks was only £3,574.

These charges, be it remembered, are in respect of works which are not allowed to earn any profit; for the Liverpool Acts only permit of as much revenue being raised from the water-consumers as will cover the necessary expenditure for working expenses and the payment of interest and sinking-funds.

The second and more important matter to which I invite your attention is that of river pollution.

There is a Royal Commission on sewage disposal now sitting which has lately issued a third report, and is preparing a fourth. The first, or interim, report contains the following expression of opinion:

"That the general protection of our rivers is a matter of such grave concern as to demand the creation of a separate Commission or a new department of the Local Government Board, which shall be a separate rivers authority, dealing with matters relating to rivers and their purification, and which, when appeal is made to

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them, shall have power to take action in cases where the Local Authorities have failed to do so."

In their third report the Commissioners refer particularly to the protection of sources of water-supply, and, in addition to a central authority exercising a general superintendence over the whole country, they recommend the formation of Rivers Boards to exercise jurisdiction over the watersheds for enforcing the provisions of the Rivers Pollution Act, with the added duty of inspecting public water-supplies and reporting to the central authority any cases of dangerous pollution. In another part of the same report they remark:

"It has been again and again pointed out by previous Commissions that to obtain effective action there should be some one authority with power to deal in each instance with the whole watershed."

They also quote the following recommendation from a Commission appointed in 1857:

"We have now to urge, as the first and all-important step towards securing the permanent improvement and protection of the rivers of the country, that a general local jurisdiction and conservancy be created throughout the kingdom, with adequate powers and proper guarantees for their due administration."

One may reasonably hope that a measure so long and consistently recommended by a succession of Royal Commissions cannot be much longer delayed.

Why is it that successive Royal Commissions have advocated the establishment of a new central authority to control and protect our rivers? The chief reasons that have been given are the apathy and indifference of existing sanitary authorities, their reluctance to enforce statutory powers to prevent pollution, and to carry out proper sewage works.

I am afraid it must be admitted that there is no evidence of these local difficulties and obstacles being removed. The evidence rather points the other way, and indicates an increasing unwillingness to incur the expense of treating sewage so as to prevent the fouling of streams. Lord Derby, in his presidential address, spoke of the abundance of air and light as the great

redeeming point of country life. His lordship knows too much of the country to add good water to the list of its advantages.

There are, of course, cases in which a remedy cannot be easily or inexpensively applied, but it ought not to be an occurrence so common as it undoubtedly is for a farm, or mill, or group of cottages to be found on the banks of a river discharging untreated sewage directly into the flowing water, and making it unfit for all users below.

With regard to gathering-grounds from which waterworks authorities are empowered to collect water, it is a suggestive fact that no new general powers for dealing with nuisances have been granted since the passing of the Waterworks Clauses Act of 1847.

The recommendation of the Royal Commission with respect to the appointment of a central authority has been, to some extent, anticipated by some of the United States of America. For example, in Massachusetts there is a State Board of Health empowered to make regulations and orders for the purpose of preventing the pollution and securing the sanitary protection of all streams and ponds used by a city, town, or water company in the Commonwealth.

One feature of that State Board which might with great advantage be introduced over here is that it is authorized and prepared to give advice to the authorities of cities and towns or to corporations or individuals, either already having or intending to introduce systems of water-supply, drainage, or sewage, as to the most appropriate method of assuring its purity and of disposing of drainage or sewage. And it is expressly provided that no person shall be compelled to bear the expense of such consultation or advice, or of experiments made in connection therewith.

There is a highly-trained staff of experts, engineers, medical men, chemists, and bacteriologists employed by the Board, whose services are freely at the disposal of any Local Authority or individual upon all questions affecting the purity of water and sewage disposal. Their services are in great demand, and the value of the advice given in each case is enhanced by the pub-

lication in the Board's Annual Report of all the letters of advice sent in response to the applications.

A great deal of the failure to carry out works for water-supply and purification, especially in rural districts, arises from the difficulty and expense of obtaining the best expert advice and the cost of chemical and bacteriological analyses. If we had a central authority, thoroughly well equipped, from which practical advice and guidance could be obtained free of cost, it would, I am convinced, be of immense benefit in securing the distribution and preservation of wholesome water, and generally in the promotion of health.

I have tried, as I proceeded, to make the practical bearing of my observations apparent. Permit me, in closing, to make the application still more personal, and to urge upon those who hear me the importance of doing all we can, after we leave this Congress, by our influence, by our practical action, and by the spread of information, to create a public opinion favourable to reform in these matters, and taught to prize the streams and rivers of our country as invaluable natural possessions, not to be sacrificed to selfish interests, but to be carefully guarded and protected, and their purity and beauty preserved for the advancement of public health and the better enjoyment of life.

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As Associate:

Ernest Quant, Torquay.

THE ACID-FAST BACTERIA,

THEIR RESEMBLANCE TO AND DIFFERENTIATION FROM THE TUBERCLE BACILLUS.

BY

ALFRED C. COLES, M.D., D.Sc. Edin.,
Bournemouth.

(*Continued from page* 681.)

THE LEPROSY BACILLUS.

DISCOVERED by Armauer Hansen in 1877, and more fully described later by Neisser, the bacillus of leprosy has long been known as an acid-fast bacillus resembling the tubercle bacillus. They are usually thin rods, measuring about 5 μ to 6 μ long, and 0·3 μ broad, generally slightly curved. When stained they show either a uniform or beaded appearance, darkly stained parts alternating with unstained points. There is no evidence that spores can be seen in their interior, and they are non-motile. They often appear tapered at one or both extremities, and sometimes club-shaped swellings are seen. They are more constant in size and are generally a little shorter than the tubercle bacillus.

They stain by the Koch-Ehrlich and Ziehl-Neelsen's method, and also by Gram. They resist decolourizing, but not quite to the same extent as the tubercle bacillus (Muir and Ritchie, Woodhead), and they take the aniline basic dyes more readily and can be more readily stained by watery solutions of these dyes than Koch's bacillus.

Macé,[3] however, states that they resist acids better than the tubercle bacillus, and, according to Babes, dilute nitric acid does not decolourize them after an hour, whilst at the end of this time the tubercle bacilli are always decolourized.

Lehmann and Neumann[2] state that the leprosy bacillus cannot be certainly differentiated from the tubercle bacillus, although it is said that the leprosy bacillus is so well stained in six or seven minutes with an aqueous solution of fuchsin that good preparations are obtained after washing in water, while the tubercle

bacillus is not. On the contrary, alkaline methylene blue is said to stain the tubercle quicker than the lepra bacillus. "Still, all authors are now agreed that the staining reaction cannot help much in the differential diagnosis, any more than the form of the bacilli, from which it follows that the separation of leprous and tuberculous affections in the cadaver appears often impossible, since at least it is made by different persons." According to Hansen and Looff, tuberculosis is responsible for 40 per cent. of the deaths in lepers, and obviously this fact further increases the difficulty of distinguishing them. Lehmann and Neumann give a differential chart, taken from an article in the *Centralbl. f. Bakter.* by Spiegel,[23] from Unna's laboratory.

Muir and Ritchie[24] say that the presence of large numbers of bacilli situated within the cells and giving the staining reaction of leprous bacilli is conclusive, and consider that in most cases there is really no difficulty in distinguishing the two organisms.

Macé states that the distinction from tubercle bacillus is easily made, in that the bacillus of leprosy is coloured in a few minutes by the ordinary solutions and by Gram, whilst the former does not stain, or only after a long action of the stain.

Neisser gives Weigert's nuclear stain as a differential means of staining.

Hansen could not obtain a pure culture of the lepra bacillus, but in 1887 Bordoni-Uffredrusi obtained a culture on glycerine serum from the marrow of a leper, but was unable to preserve it. Babes and Czaplewski succeeded later in obtaining a culture from the organs of a leper. The growth on the glycerine media—glycerine-agar, glycerine-serum-agar, and glycerine potato—was found by all observers to be delicate and slow; morphologically and biologically they were very much like the tubercle bacillus. The growth obtained by the two last-named investigators differs, according to Moëller, from the true cause of leprosy by its uncertain acid-resisting power, and is classed by Czaplewski as intermediate between the diphtheria and tubercle group of organisms. Inoculations, however, failed to produce leprous changes.

E. van Houtum[25] has quite recently announced that he has succeeded in cultivating the bacillus of leprosy. He used a

mixture consisting of $\frac{1}{3}$ beef broth and $\frac{2}{3}$ fish broth. In this broth the organisms grew rapidly, and at the end of twenty-four hours, at 36° C., there is a general turbidity.

The Smegma Bacillus.

In 1885 Tavel and Alvarez,[26] whilst investigating the so-called bacillus of syphilis, discovered in 1884 by Lustgarten,[27] found in the normal preputial smegma an acid-resisting bacillus—the bacillus of smegma.

This organism is found especially in the smegma of the prepuce, in the secretions of the outer skin, particularly where a collection of epithelium occurs, as in the anal and vulvar regions, between the toes, in the folds of the groin, and below the breasts. The smegma bacillus closely resembles the bacillus of syphilis of Lustgarten in its general morphology and staining reactions, and the fact that the latter has not been found constantly, or in sufficient numbers, in syphilitic tissues makes it very improbable that Lustgarten's bacillus is the cause of syphilis. Some authorities consider that Lustgarten's bacillus is merely the smegma bacillus which has penetrated the tissues, whilst Neumann states that it is the general opinion that Lustgarten's positive findings in gummas were to be explained by a mixed infection with tuberculosis.

The smegma bacillus, as described by Tavel and Alvarez, is extremely like the bacillus of tubercle in shape, size, and staining reaction. It can be stained by the same method, but is said to be less resistant to alcohol. The discoverers found that inoculation experiments on animals gave negative results.

Matterstock,[28] about the same time—1885—found an acid-fast bacillus in smegma which corresponded in morphological characteristics and staining reactions with that described by Tavel and Alvarez, but he was also unable to obtain a pure culture.

Laser[29] and Czaplewski[30] in 1897 independently obtained cultures of micro-organisms resisting decolourization by acids, resembling the diphtheria bacillus, which they stated were identical with the bacillus of smegma. Laser obtained his cultures from syphilitic disease, Czaplewski from gonorrhœal pus.

Fraenkel[31] denied that these diphtheria-like bacilli were identical with those described by Tavel, Alvarez, and Matterstock, and he only considers those organisms smegma which resembled the tubercle bacilli.

Fraenkel found that Laser and Czaplewski organisms did not resemble the tubercle bacilli; that they were more like pseudo-diphtheria bacilli, and that in later generations they lost their acid-resisting power.

Moëller,[17] after examining this culture, agrees with Fraenkel, and states that he was unable to get pathogenic effects in guinea-pigs with the diphtheria-like bacilli cultivated from smegma, or with secretions containing the real smegma bacilli in abundance.

Neufeld[32] has also cultivated from smegma these acid-resisting diphtheria-like bacilli, which were indistinguishable from Czaplewski's, and which possessed a moderate acid-resisting power. He had repeatedly noticed acid-resisting bacilli very like the tubercle bacillus in smegma, and these, he found, were much more acid-resisting than the diphtheria-like forms. In two cases he found a great preponderance of tubercle-like, acid-resisting bacilli over the non-acid-fast forms, and succeeded by cultivation in obtaining a great increase in the tubercle-like forms, which, he particularly remarked, possess a considerable degree of alcohol as well as acid resistance, but he was unable to procure a pure culture of the smegma bacilli. Neufeld therefore came to the conclusion that in smegma two types of acid-fast bacilli were present—those like diphtheria and those like tubercle bacilli.

Moëller[17] has quite recently succeeded in obtaining a culture of what may be regarded as true acid-fast smegma bacilli. He found accidentally, whilst working on Koch's agglutination method, that in the serum of a healthy person, after producing a blister with emp. cantharidis, tubercle-like, acid-fast bacilli were present among the epithelial cells. These were present in very small numbers, but, by placing the serum and pieces of skin in the incubator, he found that these were greatly increased in number after forty-eight hours. After three to four days the skin floating on the surface contained a very large number of these bacilli, and by means of streak cultures on glycerine-agar he was able to isolate them.

He found in this way that human serum is the best cultivating medium for the bacillus of smegma.

Morphologically, the bacilli show great variation. In young cultures they appear as slender, sometimes slightly bent rods, and are often delusively like the tubercle bacillus. In older cultures they are plumper. Culture media have great influence on their polymorphism. Especially in milk cultures, as is the case with the tubercle bacilli, alterations in form are seen—*e.g.*, threads, rods with unstained vacuoles, with club-like swellings, with deeply stained granules and coccothrix forms. The bacilli show no movement.

Their staining reaction is very like that of the tubercle bacillus. They are absolutely acid- and alcohol-fast (Moëller), independently of the medium on which they are grown. They are not decolourized by exposure to 3 per cent. HCl alcohol for twelve minutes, and the bacilli are stained in the cold by dilute carbol-fuchsin. Pure cultures react to the differential stains of Bunge and Trantenroth and Pappenheim exactly as the tubercle bacillus. The acid and alcohol resistance is not diminished in later generations. Thus Moëller found its reaction the same in the twenty-fifth generation as in the original culture.

Cultivations.—The smegma bacilli grow luxuriantly when air is allowed access to them, but in stab cultures there is only a slight growth along the stab. In the first generation they grow rather slowly at the temperature of the incubator. After about three days the original culture appears as a clear layer of colonies. After repeated transference the bacilli get used to their artificial media, and growth takes place more profusely, and after twenty-four hours a layer of colonies is visible. At the temperature of the room the growth is slower. They grow on all the usual media. On glycerine-agar, at 37° C., colonies appear as small dull gray-white scales, rounded at the edges; later, these scales overlap and appear velvety and shiny. When grown at room-temperature the dry growth persists. The water of condensation remains clear, but on the surface a slight film is formed, which creeps up the side of the glass.

On potato gray-white, dull colonies are seen.

In milk they grow rapidly and luxuriantly, and milk forms an especially good medium for growth. The milk is not coagulated, and there is no coloured growth at the edges of the surface, as is seen in the other acid-fast bacteria.

In bouillon the fluid remains clear, and on the surface a dry white film, which runs up the side of the glass, forms in three to four days. If the tube be shaken, tiny fragments fall to the bottom.

Inoculation experiments are negative. Moëller inoculated smegma contained in various secretions of the skin in rabbits into hens and doves and guinea-pigs, and has never obtained any pathogenic results. The smegma bacillus, he says, differs in this way from the other acid-fast bacteria.

Johannes Barranikow,[33] however, states that he has obtained very different results, and as a result of his experiments, draws the following conclusions :

1. Inoculation of preputial smegma from the body of a non-tubercular adult and from a healthy living child produced in guinea-pigs local and universal appearance of disease, just like that produced by the inoculation of sputum containing tubercle bacillus.

2. That smegma of various domestic animals (preputial, mammary, etc.) gave the same results by inoculation—viz., exclusively general tuberculosis.

Both these statements, Barranikow says, are in direct contra-distinction to the views and investigations of Moëller.

3. "It is desirable that those who assume that the so-called tubercle bacillus is the specific cause of disease, only because this acid-fast organism is found in tubercle, should prove that this microbe is not the so-called smegma bacillus, and that it cannot naturally or artificially be changed into one."

4. It is necessary to investigate the whole life-history of the organism.

5. That the acid-proof bacteria described by various investigators are only developmental phases of other more highly specialised organisms, and the classification into different species and genera is based on ignorance of their complete life-history.

6. That the so-called tubercle, smegma, lepra organisms are not bacilli, but rod-like developmental conditions of higher organisms.

7. The acid-fastness and non-resistance to acids are only transitory conditions of the microbe.

So far these views have not been confirmed by other investigators.

The *differential diagnosis* of smegma bacillus from true tubercle bacillus is of the greatest importance. This is especially so of the genito-urinary tract, and acid-fast bacilli found in this region could not be declared tubercle bacilli.

Moëller in doubtful cases differentiates all pseudo-tubercle bacilli by a simple method, depending on the fact of the slow growth of the tubercle bacillus and the higher temperature required for its growth. He mixes the secretion to be examined with nutrient bouillon, and keeps it at a temperature of 28° to 30° C. If in the course of a few days there is a visible increase in the bacteria resistant to acids, one can assume with certainty that the case is not one of tubercle, but pseudo-tubercle. The true tubercle bacillus requires a temperature of 37° C. for its growth, and if mixed with other bacteria would be overgrown by them before any increase could have taken place, owing to its slow growth. "Sometimes when the sputum is mixed with certain nutritive media the tubercle bacillus grows at incubation temperature. This proliferation, due in all probability to the importation of globulin-like substances from the body, is, however, exceedingly small, and ceases altogether after, at the latest, forty-eight hours, whilst in the pseudo-tubercle bacillus a persistent further proliferation takes place at 30° C." (Moëller).[35]

Timothy Grass Bacillus (Moëller).

Moëller[34] found this bacillus in grasses used for fodder, and as they were first discovered on the Timothy grass—*Phleum pratense*—he named them Timothy grass bacilli. I found it was not easy to discover these bacilli on ordinary Timothy grass, and for a considerable time absolutely failed. I made infusions of both green and dry grass, and after twelve to twenty-four hours obtained a fairly pure growth of the hay bacillus.

Moëller kindly brought to my notice Lubarsch's experiments. He obtained his grass from two different places and made infusions in sterilized water in a flask, and kept them at a temperature of 37° C. At the expiration of eighteen hours he found, mixed with the hay bacillus, numerous acid- and alcohol-fast bacilli, which were, according to Lubarsch, easily distinguished from the tubercle bacillus by their greater thickness and length. I found that mere infusion of the inflorescent part of the grass usually gave negative results, but when the whole of the grass was cut into small pieces, and infused for twelve to twenty-four hours at 37° C. a few acid-fast bacilli answering to Moëller's description were found. I am not at all sure that they can be obtained from all Timothy grass, but have certainly found them in other grasses, notably the *Alopecurus pratense*, *Bromus erectus*, and the common foa. I found, as Lubarsch states, that after forty-eight hours the acid-fast bacilli are almost completely outgrown by the hay bacilli. Lubarsch managed to get a pure culture by making his infusion with very little water, and examining hourly till such time when the Timothy bacillus were very numerous (in from nine to thirteen hours), and then by means of agar plates isolated the bacilli.

Moëller, in a private communication, states that he has also obtained the bacilli from pollen.

The Timothy, or grass i. bacillus takes the form of little rods, which are microscopically very like, and, according to Moëller, often indistinguishable from, the tubercle bacillus. Lubarsch, however, states that they are fairly easily distinguished by their greater thickness and length. Like the tubercle bacillus, this bacillus often contains deeply-stained granules, and also in some cases oval unstained patches. It divides into branches, and sometimes club-shaped swellings are found at one end. True branchings are seldom seen, and then only in dilute bouillon cultures and on Fraenkel's albumin-free medium (Lubarsch). They are not motile.

The bacilli grow on all the usual nutritive media, best at incubation temperature, indifferently at room temperature. When grown at 37° C., distinct patches of colonies are seen, and these

sooner or later become coloured. On glycerine-agar plates the colonies are after a few days of an orange-red colour and have a moist lustre, and although at first transparent, later they become darker and more opaque. Streak cultures on glycerine-agar are of a brighter orange-red colour, moist at first, but after a time become wrinkled. In bouillon there is a variable condition. Sometimes a thin pellicle is formed over the surface, and the fluid may remain clear or become turbid, but frequently a precipitate of a yellowish colour occurs.

It grows well on potato, the colonies appearing as yellowish, moist elevations.

Moëller[86] says that the cultures differ considerably from those of the tubercle bacillus, but if the Timothy bacillus is passed several times through the bodies of animals, and then grown at 37° C., it more closely resembles it, and like the tubercle it becomes slower in its growth.

This pseudo-tubercle bacillus is alcohol- and acid-fast, and behaves in the same way as the tubercle bacillus does with the ordinary staining methods. Lubarsch[9] thinks that the Timothy bacillus in the tissues of animals is not quite as resistant against decolourizing methods as the tubercle bacillus, and in this way its resisting-power is like the bacillus of leprosy. There is, he says, a slight tendency for the methylene blue to mask the red of the fuchsin, but this difference is very insignificant.

When a pure culture of the Timothy bacillus mixed with sterilized butter is injected into guinea-pigs, generally peritonitis with adhesions form, and in the organs are changes which are micro- and macroscopically very like true tubercular lesions. If it is injected into the veins or arteries of an animal, giant cells, epithelial cells, and caseation, a condition very like geniune tuberculosis, is produced. As Lubarsch says, "there can be no doubt whatever that it is quite impossible to distinguish for certainty by histological or micro-parasitic examination between Timothy fungus tubercles and true tubercles: the distinction can only be brought about by cultures. In all animals injected with Timothy bacillus a negative reaction to tuberculin was obtained" (Moëller[85]).

Lubarsch's[9] animal experiments were briefly as follows: An eight-day-old glycerine-agar culture of the Timothy bacillus was injected into the kidney of a guinea-pig. At the end of thirteen days a small piece of the kidney at the point of injection was excised, and a small yellowish mass the size of a lentil was found, apparently of a caseous material. This, microscopically, showed typical tubercular appearance—viz., masses of large epithelioid cells, amongst which are Langerhans' giant cells, and around these a proliferation of uninucleated round cells.

In the centre of this nodule the bacilli were arranged in typical radial mass, like actinomycosis, with club forms.

On the thirty-first day after the injection a piece of nodule which had formed on the kidney was excised, and it was seen that caseation had increased and the genuine Langerhans' giant cells were more numerous. The radial arrangement of the bacilli was still present, and although not more numerous than on the thirteenth day, they were larger and the clubs longer and thicker.

Grass II. Bacillus (Moëller).

Moëller[37] described this as "a new acid- and alcohol-fast bacillus of the tubercle bacillus group, which shows genuine branching."

This organism he found in the pollen on the stable-floor, in fodder grass, and in the dust of grasses generally, and was able to isolate it on gelatine plates. It takes the form of little rods, sometimes like cocci in fluid media, and morphologically and in its staining reactions it is very similar to the tubercle bacillus, but is generally somewhat thicker. When grown upon moist media it appears as little rods, which are longer and thicker than the tubercle bacillus (Lubarsch). Like the other pseudo-tubercle bacillus associated with Moëller's name, it is absolutely acid- and alcohol-fast, especially in fresh cultivations.

In older cultures, especially those made on solid media, and kept at 37° C. for four or five days, thread and branching forms are found, and these stain a pale-red with Ziehl-Neelsen's stain, having lost somewhat their power of resisting acids.

On agar the growth is very luxuriant, and when kept at 37° C. on glycerine-agar streak, after two days, small drop-like colonies, which later run into one another, are seen. The culture is then somewhat delicate, and after a few days the colonies become yellowish in colour, and in the water of condensation little skin-like flakes are seen. Lubarsch, in his account, says that, unlike the radial fungi generally, its growth on agar is soft and pulpy.

On potato, at 37° C., the growth is luxuriant, and thick grayish-white colonies are seen.

In milk the growth is very rapid, and there is an acid reaction after two to three days.

In bouillon, after three to four days at the temperature of the room, there is turbidity, and on shaking a thread-like sediment falls. A whitish-gray pellicle forms on the surface, and tends to grow up the side of the tube.

On a streak culture on gelatine at 20° C., after four to five days thick grayish-white colonies appear. No liquefaction of the gelatine.

Moëller[87] has stained these organisms by most of the tubercle bacilli stains—*e.g.*, Fraenkel's, Ehrlich's, Gabbet's, Czaplewski's, and Ziehl-Neelsen's—and finds that the bacilli in their young state resist decolourization by mineral acids and alcohol just as the tubercle bacillus. They are stained by Gram's method. They possess amœboid movement only in their young condition.

In size the bacilli vary very much. Most of them are about 1 to 5 μ long, and 0·2 to 0·4 μ broad. Especially long forms are found in the nodules which occur in infected guinea-pigs. They generally have a slightly bent shape. Similar to what has been observed in the tubercle bacillus, they often arrange themselves in the shape of a Y. Long branched and unbranched threads are found in the margins of the colonies, especially those grown on glycerine-agar for three to four days at 37° C., and sometimes fragment forms and coccothrix, particularly in milk cultures. The threads often have deeply-stained granules, which are much broader than the body of the bacillus. Swellings at one or both ends are sometimes seen. The branched forms are usually made up of a long thread, from which other thread-like branches or

short clubbed swellings start off at right angles, unlike the acute-angled branching of the cladothrix. The fine branches often divide again.

Moëller states that he has seen similar branching of the tubercle bacillus in sputum, and Kral and Dubard have found the same in the tubercle bacilli of cold-blooded animals. Zopf, of Halle, considers with Moëller that these, like some forms of the tubercle bacillus, show true branching, and not the false branching of the cladothrix, which would tend to show that these, like the tubercle bacilli, are not true bacilli, but forms more allied to the actinomyces. This opinion seems to be steadily gaining acceptance.

Lubarsch incidentally mentions that the grass ii. bacillus, as found in cultures, is rather less resistant to acids and alcohol than the tubercle bacillus or some of the pseudo-tubercle bacilli. As a result of my experiments I found that they were decolourized the earliest of all the pseudo-tubercle bacilli which I examined.

Inoculation into Animals.—According to Moëller, guinea-pigs intraperitoneally injected with a pure culture of grass ii. bacilli died at the end of four to six weeks. When milk cultures were similarly injected, the animals usually died in ten to twenty days, and presented very much the same microscopical appearance as in animals infected with Koch's tubercle bacillus, whilst in pure tuberculosis tubercle bacilli are found very sparsely in the caseated masses. In the nodules caused by the injection of these pseudo-tubercle bacilli enormous numbers of acid-fast bacilli were found in the caseous mass. Histologically the grass ii. bacilli, as also the Timothy bacilli, give rise to tubercular-like processes.

Lubarsch,[9] as a result of experimental inoculation of cultures of pure grass ii. bacilli into guinea-pigs, found that radial arrangement of the bacilli, though present, was not nearly as frequent as is the case with the Timothy bacillus or mist bacilli. He concludes that the grass ii. bacillus is not quite as pathogenic for guinea-pigs as the other two varieties, whilst Moëller thinks that it possesses greater virulence for guinea-pigs, especially when milk cultures are given intraperitoneally.

The latter remarks that the growth of the grass ii. bacillus

after its passage through the body of an animal looks almost identical with that of the tubercle bacillus which he obtained and cultivated at 20° C. from the blind-worm.

According to the same authority the grass ii. bacillus is distinguished from all acid and alcohol fast bacilli of this group by the occasional occurrence of true branching. He has found that by passing the Timothy bacillus through animals, and keeping them at 37° C. on glycerine-agar, they closely resembled the true tubercle bacillus. They all—the Timothy, grass ii., and mist bacillus—produce in guinea-pigs a miliary tuberculosis, and all show thread forms, clubs, oval unstained vacuoles and dark granules in their interior, and, like the true tubercle bacillus, are acid and alcohol fast. The grass ii. bacillus shows the same branching that is sometimes known to occur in the tubercle bacillus, and it would seem probable, according to Moëller, that the rod form of the tubercle bacillus is only a phase in the cycle of development of a more highly organized fungus, which, like grass ii. bacillus, may exist independently as a saprophyte. Both Moëller and Czaplewski have managed to grow the tubercle bacillus at ordinary room temperature. Moëller has found these three forms of pseudo-tubercle bacillus widely distributed in the vegetable substrata, and questions whether their life is symbiotic, quite harmless to the plant, or whether as a cause of plant disease, and which under certain conditions might affect human beings and animals.

THE ROYAL COLLEGE OF PHYSICIANS AND SURGEONS IN IRELAND.

Diplomas in Public Health have been granted to the following:

Critchley, Harry George, M.D. London; D'Souza, Augustus, L.R.C.P. and S. Edin., Dublin; Hall, Octavius, L.R.C.P. and S. Edin., Devonport; Powell Henry, L.R.C.P. and S. Edin., Nenagh; Whyte, George J., F.R.C.S.I.

CHEMICAL NOTES.

DETECTION OF HEATED MILK. M. SIEGFELD. (*Zeit. für angew. Chem.*, 1903, xvi., 764-773.)—A synopsis is given of all the published methods for distinguishing between raw and heated milk. The author has also made a number of experiments, in which various amides and phenols were substituted for *p*-phenylenediamine in Storch's reaction. The most sensitive and intense reaction was given by a 2 per cent. solution of di-methyl-*p*-phenylenediamine hydrochloride. This, when added to 10 c.c. of raw milk mixed with two drops of hydrogen per oxide, gave an immediate carmine-red coloration, changing to violet. Boiled milk, containing five parts of raw milk, readily gave the coloration, but no colour was obtained with boiled milk alone.

DETERMINATION OF FAT IN MILK. J. VAN HAARST. (*Zeit. für angew. Chem.*, 1903, xvi., 773-776.)—The author has compared various centrifugal methods for determining the amount of fat in milk. The Babcock-Lister process always gave too low results. Gerber's method, when properly carried out, gave good results, but showed a tendency to be a trifle too high. The method of Thörner, consisting in heating the milk with 50 per cent. potassium hydroxide solution for two minutes on the water-bath, and then adding glacial acetic acid, gave reliable results. The Adams process was used as a comparison.

A NEW TEST FOR PHENACETIN. G. M. BERINGER. (*Chemist and Druggist*, 1903, xliii., 377.)—One-tenth gramme of phenacetin is boiled for one minute with 3 c.c. of 50 per cent. sodium hydroxide solution. The mixture is then cooled and shaken with 5 c.c. of sodium hypochlorite solution. If the phenacetin be pure a clear yellow liquid will result, whilst a purple-red or brownish-red, turbid solution or precipitate indicates the presence of acetanilide.

SEPARATION OF STRYCHNINE AND QUININE. E. F. HARRISON AND D. GAIR. (*Pharm. Journ.*, 1903, xvii., 165.)—The following method, depending on the different solubilities of the tartrates of

strychnine and quinine in a solution of Rochelle Salt, was found to give accurate results. A quantity of the mixed alkaloids containing about 0·05 to 0·1 gramme of strychnine is dissolved in 60 c.c. of water slightly acidulated with sulphuric acid and ammonia added as long as the precipitate redissolves. Fifteen grammes of powdered sodium potassium tartrate are then gradually stirred in, and ammonia added until the mixture is slightly acid to litmus-paper, and the whole heated on a water-bath for fifteen minutes and allowed to cool. The quinine tartrate is filtered off, and washed with a solution of 15 grammes of sodium potassium tartrate in 45 c.c. of water made just acid with sulphuric acid. The filtrate and washings are mixed, rendered strongly alkaline with ammonia, and extracted three or four times with chloroform. After washing the chloroform solution with a little water, it is evaporated to about 5 c.c., when 10 c.c. of alcohol are added, and the mixture evaporated to dryness. The residual alkaloid is washed three times with 1 c.c. of washed ether, the washings being rejected, and the residue of practically pure strychnine dried and weighed. The presence of considerable quantities of other alkaloids does not seriously affect the accuracy of the method.

Iodometric Valuation of Chloral Hydrate. E. Rupp. (*Arch. Pharm.*, 1903, ccxli., 326; through *Chem. Zeit. Rep.*, 1903, 205.)—Caustic alkali and iodine solution convert chloral hydrate into chloroform and carbon dioxide. Twenty-five c.c. of decinormal iodine solution are mixed with 2·5 c.c. of normal potassium hydroxide in a stoppered flask, and 10 c.c. of a 1 : 100 solution of chloral hydrate are added. After standing five or ten minutes, the liquid is diluted with 50 c.c. of water, 5 c.c. of hydrochloric acid are introduced, and the whole is titrated with decinormal thiosulphate. Between 12·9 and 13·5 c.c. (100 to 95 per cent. chloral hydrate) of the reagent should be required.

The Guaiacum Test for Blood. D. Vitali. (*Boll. chim. farm.*, 1903, xlii., 177; through *Chem. Zeit. Rep.*, 1903, 217.)—Tarugi has stated that potassium thiocyanate is capable of

giving a blue-colour with guaiacum tincture in presence of old oil of turpentine; and he ascribes this fact to the oxidation of the sulphur in the thiocyanogen by the turpentine, which yields some of Caro's acid, this in turn reacting with the guaiacum. Vitali remarks that potassium and ammonium thiocyanate do give the Van Deen test, though much less strongly than hæmoglobin, the main reason being that the commercial potassium salt commonly contains a small quantity of a ferrous compound which acts (like hæmoglobin) as a carrier of the oxygen of the oxidized turpentine to the resin. With pure thiocyanates, free from iron, the blue is much weaker, but it still occurs. Vitali finds that if a mixture of potassium thiocyanate and barium chloride is shaken with old oil of turpentine, allowed to stand, filtered and boiled, the filtrate becomes turbid, which renders probable a formation of Caro's acid, persulphuric acid, or some similar unstable oxidizing body. Nevertheless, this fact does not diminish the value of the Van Deen test. Thiocyanic acid does actually exist in some animal liquids, such as urine and saliva, but in such small quantities that no confusion can arise between them and blood when examined in the dry state.

An Improvement in Seliwanoff's Test for Sugars. U. Rosin. (*Zeits. physiol. Chem.*, 1903, xxxviii., 555; through *Chem. Zeit. Rep.*, 1903, 217.)—This test may be made considerably sharper by working in the following manner: The liquid is boiled with an equal volume of hydrochloric acid and a few grains of resorcinol; if the characteristic red colour appears, it is cooled, and sodium carbonate is added till effervescence ceases. This produces a pale orange turbid liquid, which when extracted with amyl alcohol yields to the solvent a red dyestuff having a yellow tint and a slight green fluorescence, which becomes pure rose-red on the introduction of a few drops of absolute ethyl alcohol. If the amyl alcoholic solution is diluted considerably and examined spectroscopically, it shows a single band in the green between the lines E and *b*; rather stronger solutions give a very dark band, sharply defined, and overlapping the lines, also a faint ill-defined band in the blue about the line F. Concentrated solutions absorb the green. Addition of ethyl alcohol also

increases the depth of the green band. If the solution in amyl alcohol is repeatedly extracted with water, the alcoholic liquid becomes orange, and its absorption bands disappear; and if, after all alkali has been removed, ethyl alcohol is introduced into the liquid, the bands still remain absent.

ANALYSIS OF CIGARETTE SMOKE. J. J. PONTAG. (*Zeit. für Untersuch. der Nahr. und Genussmittel*, 1903, vi., 682-691.)—The cigarettes were smoked by means of an aspirator, the smoke being led through a series of five Woulf's flasks, and then into a large wide-necked vessel. The first two flasks contained 10 per cent. sodium hydroxide solution, and the three following 10 per cent. sulphuric acid. The large vessel was filled with dry cotton-wool, to absorb empyreumatic oils. Precautions were taken to prevent escape of smoke into the air by enclosing the cigarette in a glass chimney. After the smoking was finished, the contents of the first two flasks were mixed and distilled in a current of steam, the distillate being collected in the united acid liquors of the other three flasks. The residue in the distillation flask was then shaken out with ether, to remove resinous products, acidified with sulphuric acid, and distilled, the hydrocyanic acid distilling over being collected in potassium hydroxide solution and its quantity determined. The acid residue was rendered alkaline, distilled, and the nicotine, pyridine bases, and ammonia collected in acetic acid. This solution was again distilled, when pyridine bases passed over, the ammonia and nicotine remaining in the retort as acetates. The residue in the retort was made alkaline with NaHO, distilled so long as basic bodies came over, the distillate made up to a litre with water and to aliquot portions of it used for the determination of the nicotine and the nicotine plus ammonia. The nicotine was separated from the ammonia by acidifying one aliquot portion of the distillate with sulphuric acid, and precipitating the nicotine by adding potassium-bismuth iodide solution. Ammonia and nicotine were estimated together in another aliquot portion of the distillate.

The carbon monoxide in the smoke was determined by collecting the smoke in a flask over hot water, and then passing it

through a solution of palladium chloride. The weight of reduced metallic palladium gave the amount of carbon monoxide. The following are the average results obtained, expressed in percentages of the original tobacco:

Hydrocyanic acid	0·080 per cent.
Pyridine	0·146 „
Nicotine	1·165 „
Ammonia...	0·360 „
Carbon monoxide per 100 grammes ...	410 c.c.

The smoke contained 49·7 per cent. of the nicotine originally in the tobacco, but the quantity depends largely on the length of the mouthpiece.

THE DETERMINATION OF CARBONIC ACID IN DRINKING-WATER. FRED B. FORBES AND GILBERT H. PRATT. (*Journ. Amer. Chem. Soc.*, xxv., 742.)—From a number of comparative experiments as to the accuracy of the Pettenkofer, Seyler (*Analyst*, vol. xxii., 312), and direct gravimetric methods for the determination of carbonic acid, the authors conclude that the Seyler method is, on the whole, the best, the direct method requiring too much apparatus for field use, whilst the Pettenkofer method, although results given by it generally agree well with the values furnished by the other methods, occasionally gives very erratic results. The cause of these irregularities is not clear, although they are generally attributed to the presence of magnesium salts. In their preference for the Seyler method as the most accurate and convenient, the authors agree with Ellms and Benker (*Analyst*, 1901, 306). Instead of Trillich's modification of Pettenkofer's method for the determination of half-bound carbonic acid, the authors prefer a method devised by Drown, as being more convenient. In this method the water is allowed to drop down a tube 2½ feet long, ⅝ inch in diameter, drawn out at one end and filled with gravel. This tube is fitted into a bottle, a strong current of air being drawn through the whole. The half-bound carbonic acid is then determined on the water in the bottle by Pettenkofer's method.

METHODS OF STANDARDIZING PERMANGANATE SOLUTION AND ITS USE FOR THE ESTIMATION OF IRON. W. M. GARDNER, B. NORTH, and A. R. NAYLOR. (*Jour. Soc. Chem. Ind.*, 1903, xii., 731.)—Potassium permanganate may be readily purified by recrystallization twice from water. The salt should be obtained as fine needle-shaped crystals, which should be dried in a steam oven. Standard solutions are best prepared by weighing out this pure material.

If it be necessary to standardize it, either pure ammonium oxalate, oxalic acid, or granular ferrous ammonium sulphate may be used. Ammonium oxalate crystals should be used in the ordinary state, as when powdered and placed in a desiccator they are liable to effloresce. Solutions of pure ferrous ammonium sulphate in very dilute acid maintain their strength for about twenty-four hours.

When solutions of metallic iron are to be titrated with permanganate, either for the purpose of standardizing the latter or to determine the iron, graphitic carbon must first be removed by filtration or reliable results will not be obtained. If ferric salts are to be reduced with zinc, it is essential that the zinc be pure.

THE "JOURNAL OF STATE MEDICINE."

WE have much pleasure in announcing that The Journal of The Royal Institute of Public Health will, with the New Year, be considerably enlarged, and in other respects made more worthy of the important Body of which it is the official organ.

The Council have in these respects adopted the recommendations of the Journal Committee.

BOOKS, JOURNALS, REPORTS, ETC., RECEIVED.

The following books, journals, reports, etc., have been received:

Albany Medical Annals; The British Medical Journal; The Caledonian Medical Journal; The Councillor and Guardian; Egésyég; The Glasgow Medical Journal; The Journal of Association of Military Surgeons of the United States; The Journal of the Society of Chemical Industry; The Journal of Tropical Medicine; The Journal of the United Service Institution; The Lancet; La Presse Médicale; La Salute Pubblica; The Medical Times; The Medical Review; The Pharmaceutical Journal; Public Health; The Public Health Engineer; The Sanitary Record; The Surveyor.

Annual Reports:

Medical Officer of Health for the City of Capetown; Medical Officer of Health for Hertfordshire; Sanitary Engineer, Madras; Medical Officer of Health for the County of Wigan; Medical Officer of Health for the West Riding of Yorks.

Letters, Notes, Queries, etc.

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